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Feasibility of Using GEMS (Graphical Exposure Modeling System) to Perform Risk Assessments Using SARA (Superfund Amendment and Reauthorization Act of 1986) Toxic Release Inventory Information

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This study is part of the National Network for Environmental Management Studies conducted under the auspices of the Office of Cooperative Environmental Management - U. S. Environmental Protection Agency (EPA). Under Title III, Section 313 of the Superfund Amendment and Reauthorization Act of 1986 (SARA) companies which release toxic chemicals into the environment are required to report annually the amount of these toxic releases. Because the chemical toxic release reports are public information, EPA Region V is concerned that the raw data published in the toxic chemical release reports will be misinterpreted and will in turn generate unfounded public concern.

This study examines the possibility of using the Graphical Exposure Modeling System (GEMS), a computer program, to transform incoming raw data into better qualified, user ready, public information. Specifically, the report analyzes the compatibility between the raw data reported in the toxic chemical release reports and the input requirements of the GEMS exposure model. An industrial site in East St. Louis, Illinois, is used as a test site for the development of the exposure assessment.

The study discusses the research and the methods used to perform the exposure assessment. The report also reviews the legislation which requires companies to report toxic release data, the basics of exposure assessment and the GEMS model, the research methods used, and the findings of the study.

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April 13,1989

Disclaimer

This report was furnished to the U. S. Environmental Protection Agency by the graduate student identified on the cover page, under a National Network of Environmental Policy Studies fellowship.

The contents are essentially as received from the author. The opinions, findings, and conclusions expressed are those of the author and not necessarily those of the Environmental Protection Agency. Mention, if any, of company, process, or product names is not to be considered as an endorsement by the U. S. Environmental Protection Agency.

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INTRODUCTION

As a result of Title III, §313 of the Superfund Amendment and Reauthorization Act of 1986 (SARA), the Environmental Protection Agency has become more interested in the environmental effects of hazardous chemical releases. Section 313 requires companies who release toxic chemicals into the environment (whether land, air, or surface water bodies) to report annually the amounts of these toxic releases. These reports are meant to inform the general public of releases in their cities and towns.

Unfortunately, the information which is sent to the EPA and public agencies is raw data which are not readily useful in deciding if areas and populations are at risk due to the releases of chemicals from reporting companies. By releasing this information without qualifying the values or transforming the information into useful data, unfounded public concern might be generated by the reports. Region V of the EPA was interested in finding a method to evaluate the incoming data and be able to determine from the releases areas which might be considered hazardous to the surrounding population.

The use of a computer program known as GEMS which stands for Graphical Exposure Modeling System was proposed as a possible method of determining exposure levels and areas of risk through the use of the manufacturers' toxic chemical release reports. Research needed to be performed to see if the reports were compatible with the input requirements of the exposure model.

A request for research was sent to the National Network for Environmental Policy Studies (NNEPS) by Region V, from their Chicago, Illinois office. NNEPS is an organization within

the EPA allows graduate students from various universities across the United States to do research in the means of internships and fellowships.

The GEMS project was applied for and an internship was set up to run from August, 1988 through February of 1989. The project was designed to determine if GEMS could be used with the toxic release information. An industrial site int East St. Louis, Illinois was chosen as a test site for the development of the exposure assessment. Toxic release information for manufacturing companies in this area and access to the EPA's computer in Research Triangle Park, North Carolina were provided by Region V to assist with the research.

This report discusses the research and the methods used to perform the exposure assessment. The report discusses the legislation which requires companies to report toxic release data, the basics of exposure assessment and the GEMS model, the test site in East St. Louis, how the research was performed and the findings of the study.

The first chapter of the report attempts to explain the legislation which requires the submission of toxic release information from manufacturer's who release hazardous chemicals into the environment. The second chapter discusses the theories and practices of exposure assessment which include and overview of the Graphical Exposure Modeling System and the computer model which was used to run the test case. The third chapter discusses the test case and the sample site which was used for the research along with the method which was used to perform the exposure assessment. The last chapter discusses the results from the test case and the findings of the research. This last chapter answers the question of whether the toxic release reports provide enough information to be able to accurately perform an exposure assessment and offers recommendations along with these conclusions.

CHAPTER 1

SARA And the Form R Reports

The Superfund Amendments and Reauthorization Act of 1986 was signed into law on October 17, 1986. The major function of this rule was to amend and reauthorize provisions of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). Within SARA is a separate provision which is unrelated to CERCLA. This part of the law is known as the Emergency Planning and Community Right to Know Act of 1986 and is contained within Title III of SARA. This provision possesses the authority for emergency planning, notification and community information on the storage and releases of toxic chemicals.

Section 313 of the Emergency Planning and Community Right to Know Act sets forth requirements of certain manufacturing facilities to provide information to the public about the release of hazardous chemicals into the surrounding environment. The purpose of these requirements is: 1) to inform the general public about releases of toxic chemicals into the surrounding community, 2) assist research 3) to aid in the development of regulations, guidelines and standards and 4) Set forth requirements for suppliers to notify persons to whom they distribute mixtures or tradename products containing toxic chemicals that they contain these chemicals. A separate report is required for each chemical which is released into the environment. Both routine and accidental releases are required to be reported along with treatment and disposal of hazardous wastes to off-site locations.

Who is Required to Report?

Not all types of manufacturing industries must report their releases. The EPA has made a list of requirements which states the types of facilities which are and are not required exempt from reporting process.

The first exemption is for small firms with less than 10 full time employees. If the total number of employee hours, which include seasonal variations of employment and contract employees exceeds 20,000 hours for the entire year, then it is determined that there are more than 10 full-time employees within the company. This determination is made by using a full-time equivalency equation. The EPA, using generally accepted values, has decided that a full time employee works 2,000 hours a year. From this value, the company should take the total hours that all employees have worked to decide how many full-time employees the firm has. This type of calculation is used to insure that companies which use nothing but part-time employees but are still large-scale manufacturers are included in the reporting data.

A facility which is required to report toxic releases is known as a covered facility. Release reports must be submitted for facilities which manufactured, imported, processed or otherwise used a listed chemical. A listed chemical is a chemical which has been determined to be hazardous. As information about various chemicals increases, this list might change by addition or deletion of various chemicals to the register. If a listed chemical is present in a facility but is below a threshold concentration of 1% (or 0.1% for carcinogenic chemicals) then the chemical does not have to be factored into the release calculations.

In certain circumstances, facilities might not have enough information about a chemical which is in a mixture or which is purchased under a trade name from another manufacturing company. Suppliers of chemicals which are listed or are mixtures of one or more listed chemicals must produce

notifications of the amount of composition in the mixture or trade name product. If the mixture is a trade secret, the supplier must state the maximum concentration of a listed chemical in the mixture. This does not tell the true amount, but allows for a conservative estimation for exposure purposes.

If a facility is included in the Standard Industrial Classification (SIC) codes 20 through 39, then this facility is considered covered by the submitting requirements. The SIC code system is used to "classify establishments which was derived as an economic unit generally at a single physical location, where business is conducted or where services are performed." (Federal Register/ Vol. 53, No. 30/ p. 4501) A facility is defined as "all buildings, equipment, structures, and other stationary items which are located on a single site or adjacent contiguous sites owned and operated by the same person." (Federal Register/ Vol. 53, No. 30/ p. 4501) This means that a facility can be larger and more complex than an establishment and can even contain several establishments. The EPA has developed a method to deal with the problem of establishments within facilities.

1) If the establishment is the same as the facility, then the problem is dealt with in a straightforward manner.

2) If a facility has two or more establishments that all have an SIC code 20-39 the facility is considered covered.

3) If a facility has two or more establishments and one or more of the establishments has a code between 20 and 39, then the facility is considered covered if:

    a) The sum of the value of products produced or shipped by all of the establishments with codes 20-39 is greater than 50% of the total

value of all products produced or shipped by the facility, or

b) One establishment which is between codes 20 and 39 has a product value that is larger than any other establishment in the facility.

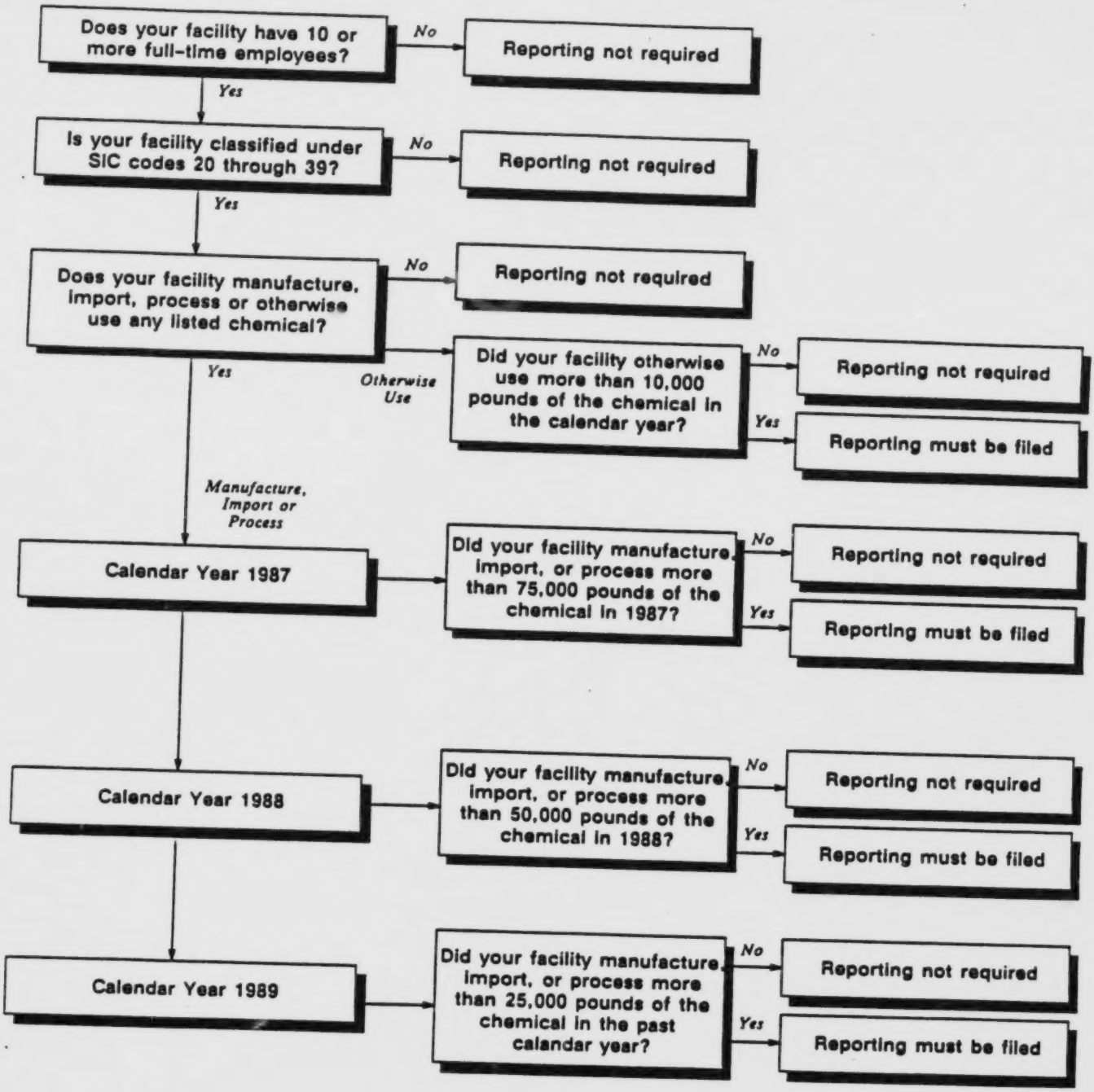
If a listed chemical was manufactured, processed or imported in an amount over 75,000 pounds in 1987, 50,000 pounds in 1988, or 25,000 pounds in 1989 or thereafter then the facility is required to report any releases into the environment. If a facility otherwise uses over 10,000 pounds of a listed chemical in a year, a report must also be submitted.

Definitions have been developed by the EPA to help clarify the meanings of manufacture, process, and otherwise use. The term manufacture means to produce, prepare, compound or import a listed toxic chemical. Process means the preparation of a listed toxic chemical, after its manufacture, for distribution in commerce. The term otherwise use encompasses any use of a listed chemical at a facility that does not fall under the definitions of manufacture or process. Chemicals which are otherwise used by a facility are chemicals which were used but not intentionally incorporated into a product distributed for commerce. (*Toxic Chemical Release Inventory Reporting Form R and Instructions* / p. 8) The use of listed chemicals for jobs such as janitorial or facility grounds maintenance, personal use by employees, or use as a structural component of the facility are not required to be reported and are exempt.

Figure 1 shows a flowchart which summarizes the requirements involved in deciding which firms are required to

Figure 1

Flowchart for Determining Applicability


Does your facility have 10 or more full-time employees?
No
Reporting not required
Yes
Is your facility classified under SIC codes 20 through 39?
No
Reporting not required
Yes
Does your facility manufacture, import, process or otherwise use any listed chemical?
No
Reporting not required
Yes
Otherwise Use
Did your facility otherwise use more than 10,000 pounds of the chemical in the calendar year?
No
Reporting not required
Yes
Reporting must be filed
Manufacture, Import or Process
Calendar Year 1987
Did your facility manufacture, import, or process more than 75,000 pounds of the chemical in 1987?
No
Reporting not required
Yes
Reporting must be filed
Calendar Year 1988
Did your facility manufacture, import, or process more than 50,000 pounds of the chemical in 1988?
No
Reporting not required
Yes
Reporting must be filed
Calendar Year 1989
Did your facility manufacture, import, or process more than 25,000 pounds of the chemical in the past calendar year?
No
Reporting not required
Yes
Reporting must be filed

report their releases. (Taken from *Toxic Chemical Release Inventory Reporting Form R and Instructions* / p. 3)

The Form R

The EPA has helped facilities which are required to submit release reports by developing a form which the facility must fill out for each toxic chemical which is released from their premises. This form is known as the Toxic Chemical Release Form R, or simply as the Form R. This form is divided into four sections: 1) Facility Identification, 2) Off-Site Locations Information, 3) Chemical Specific Information, and 4) Supplemental Information.

Part I of the report asks specific questions about the facility. Information such as company name, address and the SIC codes are required to be submitted. If there is more than one SIC classification, then all of the covered establishments must be listed. These codes are only required for establishments within the facility that are classified as SIC codes between 20 and 39. The SIC codes are listed in the appendix.. Telephone contacts, both technical and public are required to be submitted to allow for follow up information by the EPA and the general public. These contacts may be the same person if the company decides. Technical and public contacts were used to allow companies to use personnel which are more appropriate to answer either technical or general questions about the operation of the company. A public data base is being developed which will contain information which is pertinent to public concerns and will contain the public contacts from companies, but will omit the technical contact.

The specific location according to latitudinal and longitudinal coordinates are also required. This information is used specifically for graphic information systems and other computer data bases. The latitude and longitude were not required for the reports submitted in July, 1988 (1987 release

year), but will be required on the 1988 Form R reports which will be due by July 1, 1989 and on all subsequent reports. Latitude and Longitude are already required for certain environmental permits and the information is available on county property records and maps. If this information is still unavailable to companies, the *Toxic Release Inventory Reporting Form R and Instruction* booklet (EPA 560/4-88-005) explains how to determine latitudes and longitudes from topographic maps.

Various permit numbers if applicable are also required. The EPA identification number which is a 12-digit number number assigned to facilities which are subject to the authority of the Resource Conservation and Recovery Act (RCRA) is required to be submitted along with an NPDES permit number. The National Pollution Discharge Elimination System number is assigned to facilities by the EPA or state, which have released into receiving streams or water bodies. Along with the NPDES number, the name of the receiving stream or water body is required. If the facility uses underground injection of wastes into deep wells, the Underground Injection Code (UIC) identification number must be submitted also.

The second part of the report requires information about the publicly owned treatment works (POTW) and off-site locations to which wastes are transferred. The name and address of the POTW is required if wastes containing toxic chemicals are discharged to this site. All off-site locations to which toxic chemicals are released must also be reported. The name, address and RCRA ID number, if applicable, must be submitted for each off-site location.

The third part of the report gives specific information about the chemical which is being released. The Chemical Abstract Service (CAS) registry number must be entered along with the chemical's name. This number can be determined by using the list of covered chemicals which is in the appendix. If

TABLE 1
Definitions

MANUFACTURE
Produce - A chemical included in this category is produced at the facility.
Import - A chemical included in this category is imported to the facility.
For on-site use/processing - A chemical included in this category is manufactured and then further processed or otherwise used at the same facility.
For sale/distribution - A chemical in this category is manufactured specifically for sale or distribution outside the manufacturing facility.
As a byproduct - A chemical in this is category is produced coincidentally during the production, processing, use or disposal of another chemical substance or mixture, and following its production, is separated from that other chemical substance or mixture.
As an impurity - A chemical in this category is produced coincidentally with another chemical substance, and is processed used or distributed with it.
PROCESS
As reactant - A natural or synthetic chemical used in chemical reactions for the manufacture of another chemical substance or of a product. Includes, but is not limited to feedstocks, raw materials, intermediates, and initiators.
As a formulation component - A chemical added to a product or product mixture prior to further distribution of the product that aids the performance of the product in its use. Examples include, but are not limited to, additives, dyes, reaction diluents, initiators, solvents, inhibitors, emulsifiers, surfactants, lubricants, flame retardants, and rheological modifiers.
As an article component - A chemical substance that becomes an integral component of an article distributed for industrial, trade, or consumer use.
Repackaging only - Processing or preparation of a chemical or product mixture for distribution in commerce in a different form, state, or quantity.
OTHERWISE USED
As a chemical processing aid - A chemical that is added to a reaction to aid in the manufacture of synthesis of another chemical substance but does not intentionally remain in or become part of the product of mixture. Examples of such chemicals include, but are not limited to, process solvents, catalysts, inhibitors, initiators, reaction terminators, and solution buffers.
As a manufacturing aid - A chemical shose function is to aid the manufacturing process but does not become part of the resulting product. Examples include, but are not limited to, lubricants, metalworking fluids, coolants, refrigerants, and hydraulic fluids.
Ancillary or other use - A chemical in this category is used at a facility for purposes other than as a chemical processing aid or manufacturing aid as described above. Includes but is not limited to, cleaners, degreasers, lubricants, and fuels.

TABLE 2

Range Code	Weight Range in Pounds From...	To...
01	0	99
02	100	999
03	1,000	9,999
04	10,000	99,999
05	100,000	999,999
06	1,000,000	9,999,999
07	10,000,000	49,999,999
08	50,000,000	99,999,999
09	100,000,000	499,999,999
10	500,000,000	999,999,999
11	1 billion	more than 1 billion

the Chemical which is released is a mixture on which only limited information is known, then Section 2 of Part III must be filled out.

Because of the delicacy of trade secrets, the EPA has adopted methods to allow companies which produce chemicals which are necessary to be kept secret to be submitted along with regular chemicals. These trade secret chemicals must be given generic names which are descriptive of the chemical structure of the secret formula.

Along with the chemical name, the Form R report also requires information about how the chemical is used on-site. This section is split into three parts or uses: manufacture, process or otherwise use. Table 1 helps explain the categories more fully. The next section requires that the maximum amount of the chemical on-site at any time of the year be reported. This amount is given as a code which indicates the maximum quantity of the stored chemical at all sites within the facility. Table 2 shows the range and codes which are used.

Yearly totals of chemical releases to the environment are required to be submitted in section five of this part of the form. The releases are divided into five categories: 1) fugitive emissions, 2) stack or point air emissions, 3) discharges to surface water bodies, 4) underground injection, and 5) releases to land. Fugitive emissions include releases which are from leaks in valves, pumps, lines, ect.;evaporation from ponds and impoundments; and releases from ventilation systems. Stack releases are from stacks, vents, ducts, pipes or any confined air stream. Discharges to water include process outfalls, releases to on-site wastewater treatment facilities, and stormwater runoff into streams. Releases to land include chemicals which are landfilled, impounded, or otherwise disposed of at the facility. This section does not include land disposal at off-site locations. Disposal codes must be entered for the appropriate types of land disposal. These include:

D02 - Landfill
D03 - Land Treatment / Application / Farming
D05 - Surface Impoundment
D99 - Other Disposal (Includes spills and leaks)

Total releases of toxic chemicals must be reported in section five. This includes both routine as well as accidental releases. These releases do not include transfers or shipments for sale or distribution or transport or disposal of wastes to off-site locations. Information about off-site disposal is obtained in a later section.

For the release years 1987, 1988, and 1989 companies can check a certain range of release for each release to one of the five categories listed earlier. The ranges include no release (0 lbs/yr); 1-499 lbs/yr and 500-999 lbs/yr. Any amount equal to or greater than 1000 lbs/yr must be given to two significant digits. This means, for example, that an actual release of 5,391 pounds of certain chemical would be reported as 5,400 pounds for the year. Beginning with reports submitted for the 1990 year, there will no longer be any use of ranges in the reporting of releases to the environment.

In coming up with release figures, companies must use all readily available data which has been collected at the facility. These data include information necessary for other laws and regulations. When relevant data are not available, facilities may use reasonable estimates from emission factors, engineering calculations, ect. If relevant monitoring data are available, facilities can not use less accurate methods to report releases. Facilities are not required to perform extra measurements or additional monitoring test which are beyond current existing laws and regulations or routine plant operations.

The basis of the information about the amount of releases must be submitted along with the estimate. Four codes are used to distinguish the different methods of estimation. The first method (M) is based upon monitoring data or direct measurement of the toxic chemical as it was released from the facility. The next method is mass balance calculations (C). This method includes calculation of the amount of toxic chemical entering and leaving a certain process; the difference between the two amounts is considered the amount released. The third method is the use of emission factors (E) which are published by equipment manufacturers or other information sources. The last method includes other types of engineering calculations (O) which include estimations from mathematical formulas or engineering judgement. If more than one type of estimation was used for different stream of the same chemical, (i. e. monitoring for part of the waste stream, and mass balance calculations for the rest of the stream) then the letter code which would be entered would be for the method applied to the largest portion of the total stream.

Transfers of chemicals to off-site locations which were listed in Part II must be reported in Section 6. Both releases to POTWs and to off-site treatment and disposal facilities must be submitted in the Form R report. The amounts of releases are similar to Section 5 which reports releases to the environment. Reporting ranges for releases to off-site locations which are under 1000 pounds per year are used (until the 1990 reporting year) and methods of estimations use the same code as in Section 5. For off-site releases other than to POTWs, facilities must report what type of treatment or disposal will be used by the off-site facility. Table 3 gives a list of these treatment/disposal codes. Information about the off-site facilities' methods of treatment can be obtained from the annual/biennial hazardous waste treatment, storage, disposal report which is required by RCRA.

TABLE 3 Types of Treatment/Disposal	
M10	Storage Only
M20	Reuse as Fuel/Fuel Blending
M40	Solidification/Stabilization
M50	Incineration/Thermal Treatment
M61	Wastewater Treatment(Excluding POTW)
M69	Other Treatment
M71	Underground Injection
M72	Landfill/Disposal Surface Impoundment
M73	Land Treatment
M79	Other Land Disposal
M90	Other Off-Site Management
M91	Transfer to Waste Broker
M99	Unknown

Section 7 requires facilities to report their methods of waste treatment and minimalization. Once again this section is only interested in treatment of wastes on-site. Any treatment of wastes at off-site locations is covered in Part III, Section 6 of the Form R. The information which must be reported is the type of waste stream for each treatment method, the treatment method itself, the range of influent concentration, whether there is sequential treatment, treatment efficiency, and whether the efficiency is based upon operating data or published data for similar processes.

Waste streams are listed as either gaseous (A), aqueous wastewater (W), non-aqueous liquid waste (L), or solid wastes (S) which includes sludges and slurries. The treatment methods are given by codes. These codes are in the appendix. If more than one piece of equipment treat the wastes and are treating the wastes similarly (i.e. same concentrations, methods, and removal efficiencies) then it is necessary to enter the method only once. If these parameters are different for different pieces of equipment, however, each method must individually entered into the report. Concentrations are also provides by codes which range from less than 1 part per billion (ppb) which has a code of 5 to greater than 1% which has a code of 1. If sequential treatment is used, facilities might not know the treatment efficiency and concentrations between each step in the treatment. In order to cover for this, the EPA has allowed the sequential steps to be entered as one method and requires only the entering concentration and the final removal efficiency.

The last section of Part III allows the facility to provide optional information about waste minimalization efforts applied at the site. This part asks for types of modification to the wastes, quantity of chemical in waste stream prior to treatment/ disposal, ratio of reporting year production to

production in the prior year, and the reason for the minimalization.

Part IV provides extra spaces for overflow from questions asked in the three previous parts of the report.

CHAPTER 2
Exposure Assessment and GEMS

Exposure assessment is part of a larger process known as risk assessment. Risk assessment, from a hazardous chemicals point of view can be defined as "the scientific activity of evaluating the toxic properties of a chemical and the conditions of human exposure to it in order both to ascertain the likelihood that exposed humans will be adversely affected and to characterize the nature of the effects they may experience." (National Research Council) The main theme of risk assessment is the idea of quantization or characterization of the risks. This allows for predictability of results and their effects. With this predictability, bureaucrats can make informed decisions on the control of harmful chemicals which will be for the greatest benefit of both the public and the companies regulated.

Basics of Risk Assessment

Risk Assessment can be divided into four basic elements; hazard identification, dose-response assessment, exposure assessment, and risk characterization. Each one of these elements are necessary to determine the amount of risk which a person might be exposed to in a specific area.

The first element, hazard identification, identifies chemicals which might be harmful to persons if they are exposed to the material. Hazard identification is "the process of determining whether exposure to an agent can cause an increase in the incidence of a health condition (cancer, birth defects, ect.)" (National Research Council, p. 19) A hazard can be identified in several different ways. Some of the methods are much more dependable than others, but all of these classes

of information alert scientists to the possibilities of harm to persons due to exposure to a substance or substances.

Dose-response evaluation is the "process of characterizing the relation between the dose of an agent administered or received and the incidence of an adverse health effect in exposed populations and estimating the incidence of the effect as a function of human exposure to the agent." (National Research Council, p. 34) This step of risk assessment involves using extrapolation models to be able to take test data and apply the results to realistic situations. The information from hazard identification and dose-response evaluations is used to develop standards and regulations to which upper exposure limits can be drawn. The §313 chemicals were listed using this type of information.

These two steps in risk assessment give numbers which allow people to quantify the amount of exposure. Exposure Assessment uses scientific and computer models to determine the amount of a certain chemical will reach populated areas, and how much of this chemical will be ingested by the exposed group. Risk characterization uses this information along with information from dose-response evaluations to determine the amount of risk the exposed population is under.

Exposure Assessments

While hazard identifications and dose-response evaluations can be carried out in just about any laboratory and each situation will be similar, exposure assessments are very site specific. Each assessment of potential or existing exposures will differ for each different location studied whether the substance studied is the same or not. Exposure assessments are used to describe the magnitude; duration; schedule; route of exposure; size, nature and classes of the populations exposed; and the uncertainty involved. Exposure assessment can also be

used to identify possible control options and to predict the effects of available control technologies on exposures.

Information needed to generate these exposure assessments can be moderate to very extensive depending on which mathematical model is used. Typical information required includes population, weather, and topographic information; information about the release site including stack height, building sizes, and exit velocities of releases; information about the chemical is also necessary such as amount, type and physical makeup of the chemical including phase (gaseous, solid or liquid); and finally the type of release such as releases to surface waters, the atmosphere, or land-based releases.

GEMS

Many of the mathematical exposure models have been written into computer models to allow for quick and accurate calculations. Several models have been combined into a large computer program which can generate exposure concentrations in and around a release source or several release sources. The computer system was developed by General Sciences Corporation which took several of these computer models and placed them within a user friendly package along with datasets of information useful to the operation of the programs. This system is known as GEMS which stands for Graphical Exposure Modeling System. This system contains many different media models along with graphics, statistics, estimation and population information packages.

Features

Graphics and Geodata Handling - This Section of GEMS provides graphical procedures to support the computer models, statistics packages, and estimation procedures within GEMS. Graphics which are available are bar charts, isopleths, histograms and

rose diagrams. Geodata handling uses 1980 Census data along with other datasets to generate maps of states and counties within the United States. Overlays of streams and other geographic items which are stored within some of the datasets can also be accomplished.

Physiochemical Estimation Programs - As stated earlier, quite a bit of information is necessary to produce an exposure assessment. Some of the information about certain chemicals can be estimated using estimation procedures within GEMS. Some of the programs within the estimation section can calculate partition coefficients, solubility factors, soil absorption coefficients, bioconcentration factors, atmospheric degradation rates, boiling points, vapor pressures, melting points, volitalization rates and Henry's constants for chemicals. This information can used for computer modeling of chemicals or for planning purposes and determining threats from chemicals due to their persistence in the environment.

Statistics - Gems uses a number of procedures from the International Mathematical and Statistical Library (IMSL) and the SAS programs, the statistics section of GEMS can produce means, univariate and percentile results using data generated by GEMS programs. Simple and Multiple regressions and contingency tables are also available to the user in this section.

Models - The most important part of the system contains the exposure models. GEMS uses thirteen different programs to model different types of releases and exposures. These models ate broken into four classes: atmospheric models, surface water models, soil and groundwater models, and multimedia models.

Mulitmedia Models

There are three multimedia models which are available in GEMS. The models are able to model exposures of releases

that contain more than one type of release. These models offer calculations for releases to air, water and soil. The three models are the Environmental Partitioning Model (ENPART), TOXSCREEN, and the Unified Transport Model for Toxic Materials (UTM-TOX).

ENPART was designed for screening purposes and is mainly used to determine routes of exposure, and to determine bioconcentration factors and to estimate environmental persistence. This model uses equilibrium concentration ratios between the three media to determine their concentrations, partitioning factors and mass ratios. Information such as molecular weight, solubility, vapor pressure, degradation rates and information about the air, soil and water media are prompted by the interactive program. Some input values can be estimated by default values from the program if the actual values are unknown. Although this program is available through GEMS, the user is unable to apply GEMS file management or graphics programs to the model's output.

TOXSCREEN like ENPART is a screening or "first pass" model which determines the fate of the toxic chemicals which are released into the environment. This model uses media interface information for its calculations. These interfaces are between air-water, air-soil, and soil-water. Deposition velocities, transfer rate coefficients, and mass loading parameters are used to calculate the chemical dispersions. The user can select four different types of water bodies to simulate. These water bodies are: rivers, lakes, estuaries, or oceans. An interactive procedure called TOXIN has been created to allow for use with the GEMS package.

The third model, UTM-TOX is a much more complicated model which is designed to predict the dispersion of up to 20 chemicals from 10 different sources. The dispersions can be predicted over air, soil, and water simultaneously. Smaller procedures assist the model with calculations of atmospheric,

hydrologic, and soil transport. Input requirements for this model include weather data including wind roses, precipitation characteristics, solar radiation data and maximum and minimum temperatures; along with geographic data such as soil characteristics, topographic information, water characteristics and sediment data; and information pertaining to the chemical being modeled. From this information, chemical concentrations in all three media are displayed.

Soil Models

These models model the movement of chemicals through soils and groundwater tables. Two of the models, SESOIL and PRZM simulate the vertical movement of chemicals through the sublayers. The other two models AT123D and SWIP are multidimensional models which are used with groundwater pollution transport analysis. Common data required for all of the soil models are soil characteristics, depth of groundwater, and chemical properties. The output of these models contain concentrations of toxic materials throughout the soil and groundwater layers. Precipitation characteristics can also be included in these models and water wells can be included in the SWIP model.

Surface Water Model

There is only one surface water model available at this time. This model is known as EXAMS II which stands for Exposure Analysis Modeling System Two. This model evaluates the behavior and the fate of chemicals in surface water bodies. Using information both about the chemical and the water body, this model is capable of estimating the nature and fate of releases to the water system. Information about several rivers, streams and lakes are available within the program.

Three input files are required for this model: an environmental datafile which requires information about

hydrologic, climatic, biological and sedimentary information; a chemical datafile which includes solubility, partition, biodegradation, and hydrolysis parameters; and loading calculations of releases to the specific water body. There are 20 different types of tabular output available from this model. Some of the tables included in the output are maximum concentrations at specific times, distributions of chemicals in the water body, and kinetic characteristics between the chemicals and the water body.

Atmospheric Models

There are five atmospheric models within GEMS. These are GAMS, INPUFF, PTMAX, PTDIS, and BOXMOD. GAMS will be discussed in a separate section. INPUFF models accidental discharges or short term releases known also as "puffs" to the environment. PTMAX and PTDIS are both short term point source models which use steady state gaussian plume calculations to model the releases. BOXMOD models area source or fugitive releases and is used primarily for areas which contain several diffuse sources.

Input requirements for these models all require emission rates, windrose diagrams, stability characteristics and velocities. The output for these models contain information about ground level concentrations from depositions of upwind sources and from air born concentrations at ground levels.

This review of models within the GEMS system is intended to show the offerings that are available to the user of GEMS. These models were not used for this specific project and therefore detailed information is not available about them. If more information is required about GEMS or models within the GEMS system, the GEMS Handbook should be used. This handbook is available through the Office of Toxic Substances, U.S. Environmental Protection Agency, Washington, D.C.

GEMS Atmospheric Modeling Subsystem (GAMS)

This subsystem has provided the GEMS user with a package that will allow exposure estimation of atmospheric releases for both long term sources and area based releases. These types of releases may be overlapped to provide a single exposure concentration profile which could be used for risk characterization studies.

GAMS uses two atmospheric exposure models. The first model is the Long Term Industrial Source Complex Model (ISCLT). This program can model a wide variety of sources and emission types. Up to twenty different source categories and fifty different emission types can be used with an unlimited number of source locations. This expandability allows for a great deal of flexibility for modeling various sources.

ISCLT allow for gravitational settling of particulates, degradation of pollutants and for dry deposition to the ground. The model uses either stack, area, or volume source types to calculate annual ground level concentrations in a sector array around the sources. The model can calculate concentrations using a rural wind stability pattern or an urban pattern depending upon the surrounding ground characteristics.

The other GAMS model, TOXBOX is used to estimate diffuse emissions from entire regions which might contain many diffuse emission sources. This model, as its name applies, is a steady state box model, which models releases from an area or box. This model is useful for regions which have many sources such as urban areas. As with ISCLT, TOXBOX uses statistical meteorological data along with chemical information to determine ground level concentrations of a specific chemical. Chemical removal and gravitational settling are also available. Both models also use population census data to determine exposures chemical releases.

The GAMS model uses several procedures to set up an exposure study of an area, run the model, perform risk calculations, develop graphics, or modify and clean up existing studies. The first procedure, GAMSATMOSET, sets up a study in order to be run. This procedure uses a series of prompts to obtain information about the study. GAMSATMOSET is divided into sections which correspond to the procedures found in TOXBOX and ISCLT.

The first set of prompts ask for the name of the study and which programs will be used for the study. As mentioned earlier, either one or both of the models can be used for an exposure study depending upon the information available and the situation which is to be modeled. The next set of prompts asks questions about the specific chemical which will be studied. The two prompts ask for the chemical name and whether the chemical is gaseous or particulate. From these beginning prompts, the procedure goes to the exposure models which were chosen. If both of the models are used the procedure goes to the TOXBOX model first.

Input to TOXBOX

TOXBOX has three sets of prompts which must be answered in order to run the model. The first set is known as Removal Specifications. This set of prompts asks whether chemical removal or deposition processes will be used in the program and if they are what are the specific values of properties such as settling velocity, molecular weight, and particulate size.

The next series of prompts characterize the area source which will be modeled. These prompts ask for the area source category name, geographic level of emission (i.e. county, state, ect.) and emission rates. Emission rates can be entered from a previously made file or by direct prompts from the program. After the emission rates, the program asks whether the user

wishes the program to calculate exposures for the urban population or for the entire area being studied. The final series of prompts ask about output of the models results.

ISCLT Input

After the TOXBOX prompts, GAMSATMOSET will proceed to the ISCLT series of prompts (if this model has been chosen to be run). If only the ISCLT model was chosen to be run, GAMSATMOSET would have gone to the ISCLT prompts after the initial chemical information was entered.

As with TOXBOX, ISCLT's first series of prompts deals with removal specifications. This series of prompts asks the user if there will be any chemical removal, or dry deposition. If the user responds with a yes to these questions the program would require information about chemical half-life, settling velocity, and surface reflection coefficients. TOXBOX and ISCLT removal specifications are treated separately and therefore must be entered individually for both programs if the user wishes to use both models and plans to include gravitational settling and chemical removal.

The next series of prompts asks if the regulatory procedures will be used for model calculations. If these default procedures are not used, then the program will respond with prompts for information about plume rise, stack-tip downwash, and plume growth due to plume rise. This section also asks if the user is modeling sulfur dioxide.

The next set of prompts asks about the study's site locations and site's meteorologicical information. The site name and location are the first two prompts. During the site location prompt, the program asks if the location is in latitude and longitude coordinates or zip code. The GAMS Users Guide recommends the use of latitude and longitude values if they are available. Zip codes do not afford a great amount of

accuracy and could potentially throw off the results from the exposure model.

After the site location is entered, the program uses the location to display nearby stability array (STAR) stations which will be used to generate meteorological data for the exposure model. These STAR stations record frequency distributions of wind speed by directions along with atmospheric stability characteristics. The ISCLT program responds with a list of nearby weather stations which record the STAR data. This list displays each station's index number, distance to the site location, and the years the information was collected. Usually it is suggested that the nearest station be selected to be used as the source of meteorological information for the ISCLT program, but sometimes topographic effects of mountains and bodies of water require the selection of one of the other stations listed. The site location and meteorolgy sequence of prompts ends with asking which type of stability mode will be used for the study. There are two types of modes available on ISCLT currently. The first mode, rural, is used for areas which are not densely developed. The other mode, urban3, is used for areas where there are large heat sources such as downtown reas and highly developed regions.

The next set of prompts develops the polar receptor grid, which is used for the calculation of exposure concentrations. As stated earlier ISCLT and GAMS calculate ground level concentrations in polar arrays around the source. This sequence of prompts asks if the user would like to use an already specified grid or develop a specific grid for the study. If a specific grid is used, then ring distances and angles are asked for by the procedure.

The source characterization sequence of prompts identifies all of the different sources of release to the environment. Sources are defined by source category and emission type. Source categories group releases into logical

sets such as by SIC code, or by type of process or manufacture. These source categories are chosen by the user for convenience and do not effect the exposure calculations. Up to twenty source categories can be listed and up to fifty releases can be entered for each category. There are three emission types which are available for the user of the ISCLT program: these are stack, volume, and area emissions.

The stack emission type requires the user to enter the stack exit gas temperature in degrees Kelvin, the exit gas velocity in meters per second, the inner stack diameter and the height of the stack. ISCLT also uses procedures to consider building wake effects if the user so chooses. The volume emission type is used for fugitive release from buildings. The program will ask for the source width, height and length. The program assumes the release is from the center of the building so the height of the release must be divided by two. The area release asks for the width of the area in meters and then the height. The program assumes the area releases such as ponds or rooftops are square. If these are not, calculate the width by taking the square root of the area of the release.

The next section matches the model's sources with the sites which were identified earlier. The amounts of release are also prompted in this section. The stack and volume releases are required to be entered in grams per second. The area releases are entered in grams per second per square meter.

The last sequence of prompts specifies what type of output will be recorded from the model. Information available as output from the model includes all or part of the input information, ground level concentrations and the ten maximum concentrations for each site, and ground level and maximum concentrations for all combined sites. After all the GAMSATMOSET information has been entered the GAMS package will return to the subsystem's main menu.

From here the user will run the model. The procedure which is invoked is known as GAMSATMORUN. The procedure produces several files which are used by the program for subsequent runs and data for other procedures which need to use the output. The output files are also generated and are noted by ".OUT" nomenclature at the end of the file name. Both ISCLT and TOXBOX runs will have these output files.

GAMS Exposure Risk Estimation Procedure

The risk and estimation procedure is known as GAMSERE. This procedure uses the output information from both TOXBOX and ISCLT to estimate human exposures and the subsequent risk which might result. Information from census tracts is used to estimate the amount of population which might be exposed. The procedure is capable of producing two types of information. One type is comprehensive tables (CompTabs) while the other are digests which are summary tables for each source. CompTabs offer three types of tables: exposure, dose and risk while the digests have information about exposure and specific cases.

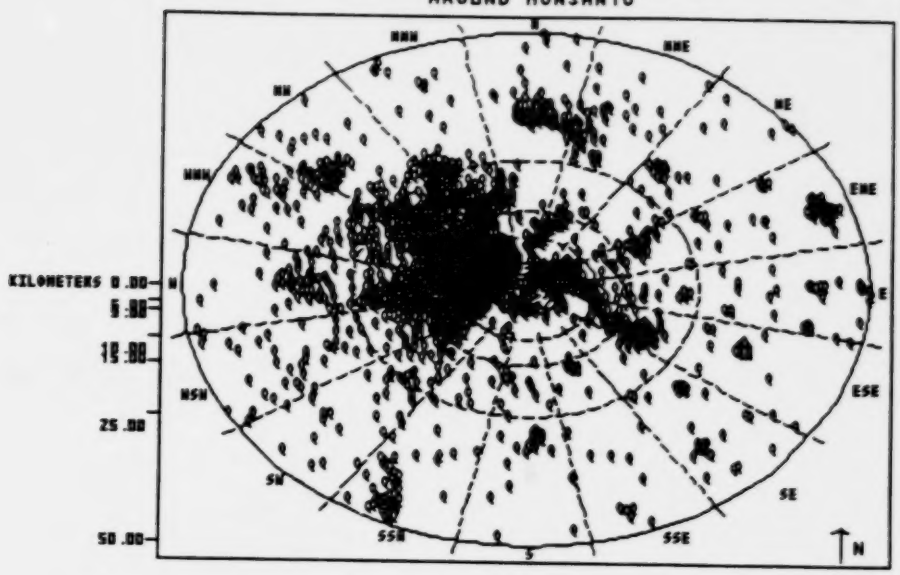
Exposure calculations for CompTabs require no additional information. All relevant data is taken from the output files generated by TOXBOX and ISCLT and from census datasets. Dose calculations require an average inhalation rate and the amount of chemical which is absorbed by the lung. A potency slope factor is required with the risk calculations along with values for body weight and inhalation rate. Default values are available for weight, inhalation rate, and fraction of chemical absorbed. Digests make tables which list the exposed population by source category, maximum and minimum population averaged concentrations and the populations at risk in order of levels of risk.

Graphics Capabilities Using GAMS

Along with the graphic capabilities that are offered by GEMS, GAMS has its own graphics procedures. These graphic procedures include population graphs, isopleths and overlays of different graphs. Population graphs plot the distribution of 1980 Census Block Groups and Enumeration Districts (BG/ED). Block Groups and Enumeration Districts are subsets of metropolitan areas and rural civil divisions respectively. These plots of BG/ED information can be generated around specific chosen areas. Figure 2 shows the population distribution around a plant in Sauget, Illinois.

Concentration isopleths can also be constructed using this graphics package. This procedure known as GAMSISOPLETH uses a source category and the estimated ground level concentrations from a model run to plot the concentration of chemicals around a site. This procedure can only be used with single site model runs because of the problems of locating a center source. The GAMSOVERLAY procedure overlays the concentration isopleth with the BG/ED plot to help show exposures and areas of risk.

BG/ED CENTROID DISTRIBUTION
AROUND MONSANTO



Chapter 3
Test Case Sauget, Illinois

Sauget, Illinois is located on the eastern side of the Mississippi River directly across from St. Louis, Missouri. This area is characterized with several manufacturing firms and railroad yards. Within this area which is also known as the American Bottoms there are around fifteen companies which qualify as covered facilities and are required to report their toxic emissions. The companies range in size from a company which reported the release of large amounts of twenty-one different chemicals in the 1987 reporting year to several small companies which only reported small releases of a single chemical.

Within a 50 kilometer ring, there live over two million people according to the 1980 Census. This figure has probably increased since that time. Most of the people live to the west of the Sauget area in St. Louis. East St. Louis which is located in Illinois and is directly north of Sauget contains some of the reporting companies also. This area is more populated than Sauget and the residential areas are fairly close to many of the manufacturing companies. Wind patterns in the Sauget area generally blow to the west and to the South.

Listed on the next two pages are the chemicals released by all the reporting companies in the Sauget/East St. Louis area. It can be noted that many chemicals such as hydrochloric acid are released from several different sources.

Table 4 Sauget Chemicals

CAS Number	Chemicals	CERCLA RQ's
000050-00-0	Formaldehyde	10 (PC)
000062-53-3	Aniline	1000 (AQTX,Acute)
000067-56-1	Methanol	5000 (AQTX,Acute)
000071-43-2	Benzene	10 (PC)
000071-55-6	1,1,1 Trichloroethane	1000 (CTX)
000075-09-2	Dichloromethane	1000 (CTX)
000075-65-0	tert-Butyl Alcohol	N/A
000078-93-3	Methyl Ethyl Ketone	1000 (CTX)
000079-01-6	Trichloroethylene	1000(AQTX) 100(PC)
000080-62-6	Methyl Methacrylate	1000 (CTX)
000088-75-5	2 Nitrophenol	5000(Acute) 100(AQTX)
000091-20-3	Napthalene	5000(Acute) 100(AQTX)
000094-75-7	2,4-D	1000(Acute,CTX) 100(AQTX)
000095-50-1	1,2 Dichlorobenzene	1000(CTX) 100(AQTX)
000100-02-7	4-Nitrophenol	5000(Acute) 100(AQTX)
000100-41-4	Ethyl Benzene	5000(Acute,CTX) 1000 (AQTX)
000100-42-5	Styrene	5000(Acute) 1000(AQTX)
000101-68-8	Methylene bis(phenylisocyanate)	N/A
000106-46-7	1,4 Dichlorobenzene	1000(CTX) 100(AQTX)
000107-21-1	Ethylene Glycol	N/A
000108-10-1	Methyl Isobutyl Ketone	5000(Acute,AQTX)
000108-31-6	Maleic Anhydride	5000(Acute,AQTX)
000108-90-7	Chlorobenzene	1000(CTX) 100(AQTX)
000108-95-2	Phenol	1000(CTX,AQTX)
000541-73-1	1,3 Dichlorobenzene	1000(CTX) 100(AQTX)
001310-73-2	Sodium Hydroxide	5000(Acute) 1000(AQTX)
001330-20-7	Xylene	5000(Acute) 1000(AQTX)
001336-36-3	PCB's	10(PC) 1(AQTX)
001344-28-1	Aluminum Oxide	N/A
007439-92-1	Lead	5000(Acute)
007440-39-3	Barium	N/A
007440-43-9	Cadmium	10(PC)
007440-47-3	Chromium	1 (and compounds)
007440-48-4	Cobalt	1 (and compounds)
007440-50-8	Copper	5000 (and compounds)
007440-66-6	Zinc	1000(CTX)
007647-01-0	Hydrochloric Acid	5000(Acute,AQTX)
007664-38-2	Phosphoric Acid	5000(Acute,AQTX)
007664-39-3	Hydrofluoric Acid	100(CTX) 5000(AQTX)
007664-41-7	Ammonia	1000(CTX) 10(AQTX)
007664-93-9	Sulfuric Acid	1000(CTX,AQTX)
007697-37-2	Nitric Acid	1000(CTX,AQTX)
007723-14-0	Phosphorous	1000(Acute) 1(AQTX)
007757-82-6	Sodium Sulfate	N/A
007782-50-5	Chlorine	1000(Acute) 10(AQTX)

Table 4 Sauget Chemicals

CAS Number	Chemicals	CERCLA RQ's
007783-20-2	Ammonium Sulfate	N/A
N/A	Arsenic Compounds	1(PC)
N/A	Barium Compounds	10(AQTX)
N/A	Cadmium Compounds	10(PC)
N/A	Copper Compounds	1000(CTX)
N/A	Lead Compounds	100(CTX,PC)
N/A	Manganese Compounds	5000(Acute) 100(AQTX)
N/A	Zinc Compounds	1000(CTX)

NOTE:
AQTX = Aquatic Toxicity
Acute = Acute Toxicity
CTX = Chronic Toxicity
PC = Potential Carcinogenicity

As shown in Chapter 2 there is a large amount of information which is needed to run the GAMS model. specific information about source characteristics is the most difficult to obtain. Information such as stack height and diameter and exit gas temperature and velocity are required by GAMS to calculate release concentrations from stacks. Also sizes for area sources and building dimensions for volume releases and building wake effects are necessary for the the program.

Unfortunately, the information required by SARA, Title III, §313 does not contain the data needed above. This information is available through other sources such as direct contact with the manufacturing company or through permits which were released by state and federal agencies. Most of the vital data which is required for exposure assessments is available from the Form R reports. The technical and public contacts which are listed in Part I of the Form R give and additional source of data for more specific information.

For exposure studies of areas that contain numerous chemical releases from several different sources this method of risk assessment becomes very time and labor intensive. Each chemical must be run separately by GAMS. For the release year 1987, the Sauget area had 53 different chemicals released into the environment.

Some of the chemical releases are from more than one source. This requires more research to determine information which is not available from the Form Rs. An example of multiple sources for one chemical in Sauget is the release of sulfuric acid which is released by eight different companies in the area. As is can be determined, very complex studies could require very large amounts of time and information to successfully complete an assessment of toxic exposures.

Many chemical releases are considered to be of low risk to the health of the surrounding population. This means that either the amount released is so small that it is not deemed hazardous or that the toxicity of the chemicals is minimal, or combinations of these two factors. Even more time and energy could be wasted studying chemicals which would not be considered hazardous from an exposure assessment point of view.

Risk Screening

This problem has been addressed by the Office of Toxic Substances of the EPA. They have come up with a quick method of determining the qualitative risk of a specific release. This method has been called risk screening and ranks potential risks as either high, medium, or low risks. The lowest risks are then screened out of the process. Risk screening uses a questionnaire (which is in the appendix) to rank the risks.

The questionnaire ranks chemicals by three specific categories:

1) Toxicological potency
2) Quantity of release
3) Exposure potential

Each category is rated as either high, medium or low.

Toxicological potency is determined by using information from CERCLA. The information used is the reportable quantities (RQ's) of listed CERCLA chemicals. These RQ's are used for accidental spills which if above the RQ must be reported. RQ's of 5000 pounds are considered to have low toxicological potency while RQ's of 1000 to 100 pounds are medium and 1 to 10 pounds have high toxicological potency. Chemicals with low toxicological potency are screened from the process.

Releases of the chemicals are divided into three different paths; air, surface water, and soil and groundwater releases. If releases to any one of these paths are greater than 50,000 pounds per year, then that release is considered to have a high quantity of release. Between 50,000 and 5,000 pounds per year is a medium release and less than 5,000 pounds per year is a low quantity of release.

During the next screening process, low releases of high toxicological potency chemicals are listed only if the chemical is considered to be persistent in the environment. The same situation applies for medium releases of medium toxicity. Medium potency chemicals of low quantity are excluded from the screening process. High quantity/high potency chemicals and high quantity/medium potency chemicals remain for further screening procedures. After this process, low and possibly some medium risk chemicals have been screened out of the risk analysis.

For each plausible route of exposure, a group of questions with confidence limits are asked by the questionnaire to determine the risks of exposure from each route. The instructions suggest that any chemicals which should be looked at more closely but were screened out in earlier stages should be reincluded. When the questionnaire is completed, there will be a list of chemical releases which will be considered to be of high or medium risk. These situations can then be analyzed using an exposure assessment model to determine the computed quantitative risk.

Discussion of Work

For the test case in Sauget, Illinois two data bases were developed to help bring together all the pertinent data which were necessary to perform the risk screening and eventually the risk assessment. Data bases were developed for both individual chemicals which contained the CAS number, the

chemical name, the CERCLA RQ, and the company or companies which released the chemical into the environment. The other data base pulled important information off of the Form R reports. This data base divided the releases by company. Under each company name there were entries for the chemical, the CAS number, the CERCLA RQ's, the amounts and types of release, and comments which could be relevant to the risk analysis. A separate entry also gave pertinent information about the facility including the address, latitude and longitude, and the public and private contacts. Both data bases are included in the appendix.

From this information the risk screening process was performed. First, all of the chemicals which had RQ's of 5,000 pounds were excluded. There were several chemicals which had different RQ's depending on which type of toxicity was of concern. For instance, there were three types of reportable quantity values available to use. These were acute toxicity, which measured amounts of chemicals which could be harmful from short exposures; chronic toxicity which measured amounts which would be considered hazardous for long-term exposures; and aquatic toxicity which takes into account the dangers from chemicals which are released into surface waters.

Since most of the releases were to the atmosphere, chronic and acute toxicities were used most often for the RQ's. If releases to water bodies were present, aquatic toxicities were used. Some chemicals did not have CERCLA RQ's at all. These chemicals were assigned an RQ of 100 pounds so that no oversites would be made. This assumption was in accordance with the Risk Screening Guide which suggested assigning relatively toxic RQ's to make conservative estimates. See figure 3 for a list of the proper uses of the RQ's.

From the toxicological potency screen, fifteen of the fifty three chemicals were excluded. Seven chemicals did not have any listed RQ's. Nine chemicals were listed as having a high

EXHIBIT 9 - USING RQS IN THE RISK SCREENING SYSTEM

Assigning the appropriate RQ to a Section 313 chemical will depend upon your understanding of the target populations/organisms of concern and the reported chemicals' likely release rates. Choosing the lowest RQ in the examples below will give you conservative results for risk screening.

- If you are concerned about health and ecological effects, select the lowest RQ value from among the four RQs for that chemical: aquatic toxicity, acute mammalian toxicity, chronic toxicity, and potential carcinogenicity.

- If you are concerned about aquatic effects only, select the aquatic toxicity RQ.

- If you are concerned about human health effects only, select the lowest RQ from among the three human health values.

- If you are concerned only about human health effects and if release data indicate a frequent or relatively continuous release that implies relatively long-term exposure, use the lower of the potential carcinogenicity and chronic toxicity RQs.

Other guidelines apply to mixtures or trade secret substances for which generic names have been given; to chemical categories; and to chemicals for which no RQ has been assigned.

- Generic names. If you can ascertain from the generic name the types of chemicals that might be components of the substance, you can select from among the most toxic of these chemicals for risk screening. If, however, you can't make such a determination, consult with the facility to collect sufficient information to put boundaries on the potential toxicity of the substance.

- Chemical categories. Some chemicals that make up the 20 categories listed under Section 313 have RQs. Select the most toxic of the chemicals listed in the category that exhibits the same properties (e.g., physical state) as the compound of concern. Absent any information on the toxicity of the reported compound, you should generally use the most toxic chemical listed in the category for conservative risk sceeening.

- No RQ. If a chemical does not have an RQ, you can assign a relatively toxic RQ (i.e., 10 or 100) to the chemical for the purposes of screening. Again, assuming relatively high toxicity will result in the most conservative screening.

toxicological potency while the rest were of medium potency. From the thirty-eight chemicals which remained, three lists were made. Two lists listed the atmospheric releases of high and medium toxicity chemicals respectively, while the third listed releases to surface waters and POTW's. There were no land based releases which survived the first screening process. Each company which released one of these chemicals was placed on these lists.

From consultation and research, it was decided to ignore the POTW releases since treatment by the plant was assumed to remove all toxics from the effluent. Low quantity releases from medium toxicity chemicals were also omitted from the lists leaving a total of fifteen chemicals on the medium toxicity list. Of the nine chemicals from the high toxicity list, only one chemical had a release of greater than 5,000 pounds per year. This chemical along with the fifteen chemicals from the medium toxicity list were run through the screening questionnaire.

From the risk screening questionnaire, benzene was considered to be most hazardous release into the Sauget area. The chemical was reported to have been released from two sites by both fugitive and stack releases. The total amount of benzene, which is considered carcinogenic, which was released was 60,300 pounds for the reporting year 1987. This information was taken from Form R data submitted by the two companies which release benzene in the area. An exposure and risk assessment of this chemical was planned. It was determined that due to time constraints, only the worst case would be run through the GEMS package to determine quantitative risk. If this release was found to be extremely hazardous, then the other chemicals, which were considered by the risk screening process to be less hazardous, would be run through the program also.

Information was then obtained for the specific releases of benzene into the atmosphere from the technical contacts of the companies which released the chemical and from Region V of the EPA. This information was then used to run the GAMS program. The appendix shows the variables which were entered into the model.

Assumptions Made to GAMS Input

Because of the lack of specific information in certain instances assumptions were made for some of the GAMSATMOSET prompts. Some assumptions might be more questionable than others, but for the sake of factuality, all entries to the model which could not be verified are listed below.

1) Benzene's physical state was assumed to be gaseous instead of particulate.

2) There was no chemical removal through degradation.

3) There was no dry deposition.

4) Ethyl Petroleum, one of the companies which released benzene into the area, stated that the location of their plant by latitude and longitude was 38/45/00 latitude and 90/08/00 longitude. By checking topographic maps with their address and zip code, this location was concluded to be in error. A substitute position of 38/35/00 latitude and 98/08/00 longitude was used.

5) The urban mode U3 was used instead of rural because of the large heat sources of the Mississippi River and buildings surrounding both manufacturing plants.

6) The fugitive emissions for both companies were assumed to be area source releases seeping through roof tops of buildings and the height of release was 6.1 meters (20 feet) and had an area of 30 square meters.

7) Concentrations of benzene from the two stacks which released the chemical at the Monsanto plant were assumed to be equal; therefore one stack which released three times as much benzene as the other had an exit velocity three times as great due to the same inside diameter of the two stacks.

8) Building height and width for wake effects were assumed to be 6.1 meters tall and 30 meters wide.

Assumptions were only used when information was unobtainable. The assumptions used are believed to cause inappreciable differences in the output and necessary to complete the model's input requirements.

Results

GAMS generated wind rose diagrams and concentration tables for the Sauget area. The tables listed concentrations for each source and then for a combination of all sources. A table of the ten greatest concentrations was also produced. The concentrations of the combined sources and the table of the ten greatest concentrations are shown in tables 5 and 6. A graphical isopleth was generated manually to show the areas of the highest concentrations. This graph was done manually because the study had two sources. Because of this, the GAMS program was unable to generate its own isopleth. The graph is shown in figure 4.

The greatest concentration of benzene calculated by ISCLT was found to be 11.72 micrograms per cubic meter, which for benzene equals 3.42 parts per billion. This value is

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) FROM ALL SOURCES COMBINED **

- GRID SYSTEM RECEPTORS -
- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	166.670	333.330	500.000	666.670	833.330	1000.000	1333.330	1666.670	2000.000
	- CONCENTRATION -								
337.500	0.8816E+01	0.2643E+01	0.1272E+01	0.7563E+00	0.5063E+00	0.3655E+00	0.2197E+00	0.1490E+00	0.1088E+00
315.000	0.9366E+01	0.2884E+01	0.1408E+01	0.8441E+00	0.5686E+00	0.4125E+00	0.2497E+00	0.1700E+00	0.1246E+00
292.500	0.1043E+02	0.3368E+01	0.1687E+01	0.1029E+01	0.7018E+00	0.5140E+00	0.3157E+00	0.2171E+00	0.1605E+00
270.000	0.9331E+01	0.2970E+01	0.1474E+01	0.893[illegible]E+00	0.6059E+00	0.4420E+00	0.2697E+00	0.1846E+00	0.1360E+00
247.500	0.5173E+01	0.1542E+01	0.7394E+00	0.4385E+00	0.2930E+00	0.2114E+00	0.1270E+00	0.8603E-01	0.6286E-01
225.000	0.4170E+01	0.1270E+01	0.6166E+00	0.3684E+00	0.2476E+00	0.1792E+00	0.1082E+00	0.7352E-01	0.5384E-01
202.500	0.4842E+01	0.1518E+01	0.7483E+00	0.451[illegible]E+00	0.3057E+00	0.2226E+00	0.1355E+00	0.9261E-01	0.6809E-01
180.000	0.5448E+01	0.1695E+01	0.8318E+00	0.5000[illegible]+00	0.3370E+00	0.2445E+00	0.1479E+00	0.1006E+00	0.7365E-01
157.500	0.4113E+01	0.1196E+01	0.5666E+00	0.3331E+00	0.2212E+00	0.1586E+00	0.9441E-01	0.6353E-01	0.4613E-01
135.000	0.5744E+01	0.1702E+01	0.8141E+00	0.4816E+00	0.3208E+00	0.2307E+00	0.1377E+00	0.9284E-01	0.6749E-01
112.500	0.9219E+01	0.2817E+01	0.1369E+01	0.8185E+00	0.5497E+00	0.3979E+00	0.2400E+00	0.1629E+00	0.1191E+00
90.000	0.1172E+02	0.3787E+01	0.1896E+01	0.1155E+01	0.7869E+00	0.5757E+00	0.3527E+00	0.2420E+00	0.1785E+00
67.500	0.8506E+01	0.2630E+01	0.1287E+01	0.77[illegible]E+00	0.5218E+00	0.3791E+00	0.2301E+00	0.1570E+00	0.1153E+00
45.000	0.5707E+01	0.1772E+01	0.8694E+00	0.52[illegible]E+00	0.3534E+00	0.2570E+00	0.1562E+00	0.1066E+00	0.7843E-01
22.500	0.5434E+01	0.1558E+01	0.7314E+00	0.427[illegible]E+00	0.2832E+00	0.2028E+00	0.1206E+00	0.8110E-01	0.5894E-01
0.000	0.1042E+02	0.3374E+01	0.1692E+01	0.1031[illegible]+01	0.7017E+00	0.5131E+00	0.3139E+00	0.2151E+00	0.1585E+00

- GRID SYSTEM RECEPTORS -
- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	2333.330	2666.670	3000.000	3333.330	3666.670	4000.000	4333.330	4666.670	5000.000
	- CONCENTRATION -								
337.500	0.8365E-01	0.6683E-01	0.5490E-01	0.4611E-01	0.3941E-01	0.3418E-01	0.3002E-01	0.2663E-01	0.2394E-01
315.000	0.9612E-01	0.7694E-01	0.6331E-01	0.5325E-01	0.4555E-01	0.3957E-01	0.3478E-01	0.3088E-01	0.2765E-01
292.500	0.1245E+00	0.1001E+00	0.8275E-01	0.6984E-01	0.5992E-01	0.5218E-01	0.4596E-01	0.4088E-01	0.3667E-01
270.000	0.1052E+00	0.8445E-01	0.6970E-01	0.5876E-01	0.5037E-01	0.4384E-01	0.3858E-01	0.3430E-01	0.3076E-01
247.500	0.4837E-01	0.3865E-01	0.3178E-01	0.2672E-01	0.2285E-01	0.1985E-01	0.1745E-01	0.1549E-01	0.1388E-01
225.000	0.4150E-01	0.3322E-01	0.2736E-01	0.2303E-01	0.1973E-01	0.1715E-01	0.1508E-01	0.1340E-01	0.1202E-01
202.500	0.5266E-01	0.4223E-01	0.3483E-01	0.2935E-01	0.2516E-01	0.2198E-01	0.1926E-01	0.1712E-01	0.1535E-01
180.000	0.5674E-01	0.4538E-01	0.3733E-01	0.3139E-01	0.2685E-01	0.2332E-01	0.2050E-01	0.1820E-01	0.1630E-01
157.500	0.3533E-01	0.2812E-01	0.2306E-01	0.193[illegible]E-01	0.1650E-01	0.1430E-01	0.1254E-01	0.1112E-01	0.9948E-02
135.000	0.5172E-01	0.4119E-01	0.3378E-01	0.2832E-01	0.2416E-01	0.2094E-01	0.1837E-01	0.1628E-01	0.1457E-01
112.500	0.9171E-01	0.7329E-01	0.6024E-01	0.5062E-01	0.4327E-01	0.3755E-01	0.3298E-01	0.2927E-01	0.2620E-01
90.000	0.1383E+00	0.1111E+00	0.9175E-01	0.773[illegible]E-01	0.6636E-01	0.5777E-01	0.5086E-01	0.4523E-01	0.4057E-01
67.500	0.8904E-01	0.7139E-01	0.5885E-01	0.495[illegible]E-01	0.4248E-01	0.3695E-01	0.3252E-01	0.2890E-01	0.2592E-01
45.000	0.6059E-01	0.4860E-01	0.4010E-01	0.33[illegible]0E-01	0.2897E-01	0.2521E-01	0.2219E-01	0.1974E-01	0.1770E-01
22.500	0.4519E-01	0.3604E-01	0.2959E-01	0.248[illegible]E-01	0.2124E-01	0.1843E-01	0.1619E-01	0.1437E-01	0.1288E-01
0.000	0.1227E+00	0.9846E-01	0.8125E-01	0.6849[illegible]E-01	0.5871E-01	0.5108E-01	0.4496E-01	0.3997E-01	0.3585E-01

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) FROM ALL SOURCES COMBINED (CONT.) **

- GRID SYSTEM RECEPTORS -
- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	6666.670	8333.330	10000.000	11666.670	13333.330	15000.000	18333.330	21666.670	25000.000
	- CONCENTRATION -								
337.500	0.1515E-01	0.1080E-01	0.8263E-02	0.6645E-02	0.5529E-02	0.4715E-02	0.3619E-02	0.2914E-02	0.2425E-02
315.000	0.1762E-01	0.1254E-01	0.9587E-02	0.7697E-02	0.6385E-02	0.5432E-02	0.4152E-02	0.3330E-02	0.2762E-02
292.500	0.2345E-01	0.1670E-01	0.1272E-01	0.1015E-01	0.8377E-02	0.7080E-02	0.5342E-02	0.4235E-02	0.3476E-02
270.000	0.1966E-01	0.1402E-01	0.1072E-01	0.8591E-02	0.7108E-02	0.6031E-02	0.4584E-02	0.3659E-02	0.3021E-02
247.500	0.8849E-02	0.6311E-02	0.4827E-02	0.3872E-02	0.3212E-02	0.2730E-02	0.2082E-02	0.1667E-02	0.1381E-02
225.000	0.7688E-02	0.5495E-02	0.4209E-02	0.3378E-02	0.2803E-02	0.2383E-02	0.1818E-02	0.1455E-02	0.1205E-02
202.500	0.9814E-02	0.7003E-02	0.5355E-02	0.4291E-02	0.3555E-02	0.3018E-02	0.2296E-02	0.1834E-02	0.1515E-02
180.000	0.1040E-01	0.7439E-02	0.5714E-02	0.4606E-02	0.3842E-02	0.3283E-02	0.2529E-02	0.2043E-02	0.1705E-02
157.500	0.6313E-02	0.4503E-02	0.3459E-02	0.2795E-02	0.2339E-02	0.2006E-02	0.1556E-02	0.1264E-02	0.1061E-02
135.000	0.9263E-02	0.6625E-02	0.5102E-02	0.4128E-02	0.3458E-02	0.2969E-02	0.2307E-02	0.1877E-02	0.1577E-02
112.500	0.1667E-01	0.1189E-01	0.9118E-02	0.7340E-02	0.6115E-02	0.5221E-02	0.4016E-02	0.3241E-02	0.2702E-02
90.000	0.2596E-01	0.1853E-01	0.1416E-01	0.1134E-01	0.9395E-02	0.7970E-02	0.6056E-02	0.4832E-02	0.3988E-02
67.500	0.1658E-01	0.1184E-01	0.9050E-02	0.7247E-02	0.5999E-02	0.5088E-02	0.3863E-02	0.3080E-02	0.2540E-02
45.000	0.1134E-01	0.8105E-02	0.6197E-02	0.4961E-02	0.4105E-02	0.3479E-02	0.2637E-02	0.2100E-02	0.1730E-02
22.500	0.8217E-02	0.5871E-02	0.4495E-02	0.3619E-02	0.2997E-02	0.2549E-02	0.1946E-02	0.1559E-02	0.1292E-02
0.000	0.2294E-01	0.1640E-01	0.1256E-01	0.1007E-01	0.8375E-02	0.7124E-02	0.5439E-02	0.4358E-02	0.3611E-02

- GRID SYSTEM RECEPTORS -
- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	33333.340	41666.672	50000.000
	- CONCENTRATION -		
337.500	0.1686E-02	0.1277E-02	0.1020E-02
315.000	0.1907E-02	0.1436E-02	0.1142E-02
292.500	0.2348E-02	0.1738E-02	0.1361E-02
270.000	0.2066E-02	0.1544E-02	0.1220E-02
247.500	0.9503E-03	0.7140E-03	0.5665E-03
225.000	0.8290E-03	0.6226E-03	0.4938E-03
202.500	0.1038E-02	0.7769E-03	0.6144E-03
180.000	0.1191E-02	0.9057E-03	0.7255E-03
157.500	0.7501E-03	0.5753E-03	0.4642E-03
135.000	0.1117E-02	0.8575E-03	0.6925E-03
112.500	0.1385E-02	0.1431E-02	0.1145E-02
90.000	0.2725E-02	0.2036E-02	0.1607E-02
67.500	0.1734E-02	0.1294E-02	0.1021E-02
45.000	0.1178E-02	0.8770E-03	0.6908E-03
22.500	0.8903E-03	0.6696E-03	0.5319E-03
0.000	0.2487E-02	0.1869E-02	0.1484E-02

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) FROM ALL SOURCES COMBINED (CONT.) **

- PROGRAM DETERMINED MAXIMUM 10 VALUES -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
166.67	90.00	0.1172E+02
166.67	292.50	0.1043E+02
166.67	0.00	0.1042E+02
166.67	315.00	0.9256E+01
166.67	270.00	0.9231E+01
166.67	112.50	0.9219E+01
166.67	337.50	0.8816E+01
166.67	67.50	0.8806E+01
166.67	135.00	0.8744E+01
166.67	45.00	0.8707E+01

Figure 4

Concentrations of Benzene
Sauget, Illinois

Latitude 38° 35' 45"
Longitude 90° 10' 00"

> 10 µg/m^3
7.5 - 10 µg/m^3
5.0 - 7.4 µg/m^3
2.5 - 4.9 µg/m^3
1.0 - 2.4 µg/m^3
< 1 µg/m^3

far below the OSHA standards which are listed as 10 parts per million for benzene. The reading from the ISCLT program was located just 166.67 meters from the source. This close range would probably not even be outside the facility property line.

Risk estimations were also run using population data and a unit risk factor (URF) for benzene of 8.3×10^{-6} $(\mu g/m^3)^{-1}$. The greatest risk was found to be 4.79 x 10-6 which when extrapolated to the entire population would cause an extra cancer death every 2,063 years. As can be determined by the results, the risk posed by the benzene releases is considered minimal.

CONCLUSION

From this study there has been several conclusions which have been reached by using the GEMS program and the atmospheric exposure models.

1) The GEMS program is capable of performing risk calculations using data from SARA Form R reports.

2) Supplemental information from sources other than Section 313 data are necessary in order to perform risk analyses using computer models other than simple first pass programs.

3) Risk assessments for areas which contain several sources and many different chemicals require extensive research to obtain information vital to the assessment.

4) Many toxic releases are of such low quantity and low toxicity that they should not be considered to be hazardous.

5) The use of Risk Screening can cut the amount of research and data input to risk assessment programs by screening out low risk situations and allowing more energy to be spent on risk situations which are more hazardous to the surrounding population.

There are a few recommendations which have been developed from the research which has been done on this project.

1) Make supplemental information such as stack heights, diameters, exit gas temperatures, and exit velocities more available to risk assessors.

2) Use the risk screening process to cut down the number of chemicals which must be analyzed in order to perform a risk assessment.

3) Risk screening should not be used as an alternative to risk assessment, but as an aid to make the risk assessment process more streamlined.

Risk assessment is a very important tool in the management and communication of toxic hazards. This tool could be more effective by using the risk screening method to allow for more risk analyses and thus increase the amount of risk studies performed.

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APPENDIX

TABLE I

SIC CODES 20-39

20 Food and Kindred Products

2011 Meat packing plants
2013 Sausages and other prepared meat products
2016 Poultry dressing plants
2017 Poultry and egg processing
2021 Creamery butter
2022 Cheese, natural and processed
2023 Condensed and evaporated milk
2024 Ice cream and frozen desserts
2026 Fluid milk
2032 Canned specialties
2033 Canned fruits, vegetables, preserves, jams and jellies
2034 Dried and dehydrated fruits, vegetables, and soup mixes
2035 Pickled fruits and vegetables, vegetable sauces and seasonings, and salad dressings
2037 Frozen fruits, fruit juices and vegetables
2038 Frozen specialties
2041 Flour and other grain mill products
2043 Cereal breakfast foods
2044 Rice milling
2045 Blended and prepared flour
2046 Wet corn milling
2047 Dog, cat and other pet food
2048 Prepared feeds and feed ingredients for animals and fowls, n.e.c.*
2051 Bread and other bakery products, except cookies and crackers
2052 Cookies and crackers
2061 Cane sugar, except refining only
2062 Cane sugar refining
2063 Beet sugar
2065 Candy and other confectionery products
2066 Chocolate and cocoa products
2067 Chewing gum
2074 Cottonseed oil mills
2075 Soybean oil mills
2076 Vegetable oil mills, except corn, cottonseed, and soybean
2077 Animal and marine fats and oils
2079 Shortening, table oils, margarine and other edible fats and oils, n.e.c.*
2082 Malt beverages
2083 Malt
2084 Wines, brandy, and brandy spirits
2085 Distilled, rectified, and blended liquors
2086 Bottled and canned soft drinks and carbonated waters
2087 Flavoring extracts and flavoring syrups, n.e.c.*
2091 Canned and cured fish and seafoods
2092 Fresh or frozen packaged fish and seafoods
2095 Roasted coffee
2097 Manufactured ice
2098 Macaroni, spaghetti, vermicelli and noodles
2099 Food preparations, n.e.c.*

21 Tobacco Manufacturers

2111 Cigarettes
2121 Cigars
2131 Tobacco (chewing and smoking) and snuff
2141 Tobacco stemming and redrying

22 Textile Mill Products

2211 Broad woven fabric mills, cotton
2221 Broad woven fabric mills, man-made fiber and silk
2231 Broad woven fabric mills, wool (including dyeing and finishing)
2241 Narrow fabrics and other smallwares mills: cotton, wool, silk, and man-made
2251 Women's full length and knee length hosiery
2252 Hosiery, except women's full length and knee length hosiery
2253 Knit outerwear mills
2254 Knit underwear mills
2257 Circular knit fabric mills
2258 Wrap knit fabric mills
2259 Knitting mills, n.e.c.*
2261 Finishers of broad woven fabrics of cotton
2262 Finishers of broad woven fabrics of man-made fiber and silk
2269 Finishers of textiles, n.e.c.*
2271 Woven carpets and rugs
2272 Tufted carpets and rugs
2279 Carpets and rugs, n.e.c.*
2281 Yarn spinning mills; cotton, man-made fibers and silks
2282 Yarn texturising, throwing, twisting, and winding mills; cotton, man-made fibers and silk
2283 Yarn mills, wool, including carpet and rug yarn
2284 Thread mills
2291 Felt goods, except woven felts and hats
2292 Lace goods
2293 Paddings and upholstery filling
2294 Processed waste and recovered fibers and flock
2295 Coated fabrics, not rubberized
2296 Tire cord and fabric
2297 Nonwoven fabrics
2298 Cordage and twine
2299 Textile goods, n.e.c.*

23 Apparel and Other Finished Products made from Fabrics and Other Similar Materials

2311 Men's, youths', and boys' suits, coats and overcoats
2321 Men's, youth's, and boys' shirts (except work shirts), and nightwear
2322 Men's, youth's, and boys' underwear
2323 Men's, youth's, and boys' neckwear
2327 Men's, youth's, and boys' separate trousers
2328 Men's, youth's, and boys' work clothing
2329 Men's, youth's, and boys' clothing, n.e.c.*
2331 Women's, misses', and juniors' blouses, waists, and shirts
2335 Women's, misses', and juniors' dresses
2337 Women's, misses', and juniors' suits, skirts, and coats
2339 Women's, misses', and juniors', outerwear, n.e.c.*
2341 Women's, misses', children's, and infants' underwear and nightwear
2342 Corsets and allied garments
2351 Millinery
2352 Hats and caps, except millinery

2361 Girls', children's and infants' dresses, blouses, waists and shirts
2363 Girls', children's and infants' coats and suits
2369 Girls', children's and infants' outerwear, n.e.c.*
2371 Fur goods
2381 Dress and work gloves, except knit and all leather
2384 Robes and dressing gowns
2385 Raincoats and other waterproof outer garments
2386 Leather and sheep lined clothing
2387 Apparel belts
2389 Apparel and accessories, n.e.c.*
2391 Curtains and draperies
2392 Housefurnishings, except curtains and draperies
2393 Textile bags
2394 Canvas and related products
2395 Pleating, decorative and novelty stitching, and tucking for the trade
2396 Automotive trimmings, apparel findings, and related products
2397 Schiffli machine embroideries
2399 Fabricated textile products, n.e.c.*

24 Lumber and Wood Products, Except Furniture

2411 Logging camps and logging contractors
2421 Sawmills and planing mills, general
2426 Hardwood dimension and flooring mills
2429 Special products sawmills, n.e.c.*
2431 Millwork
2434 Wood kitchen cabinets
2435 Hardwood veneer and plywood
2436 Softwood veneer and plywood
2439 Structural wood members, n.e.c.*
2441 Nailed and lock corner wood boxes and shook
2448 Wood pallets and skids
2449 Wood containers, n.e.c.*
2451 Mobile homes
2452 Prefabricated wood buildings and components
2491 Wood preserving
2492 Particleboard
2499 Wood products, n.e.c.*

25 Furniture and Fixtures

2511 Wood household furniture, except upholstered
2512 Wood household furniture, upholstered
2514 Metal household furniture
2515 Mattresses and bedsprings
2517 Wood television, radio, phonograph, and sewing machine cabinets
2519 Household furniture, n.e.c.*
2521 Wood office furniture
2522 Metal office furniture
2531 Public building and related furniture
2541 Wood partitions, shelving, lockers, and office and store fixtures
2542 Metal partitions, shelving, lockers and office and store fixtures
2591 Drapery hardware and window blinds and shades
2599 Furniture and fixtures, n.e.c.*

26 Paper and Allied Products

2611 Pulp mills
2621 Paper mills, except building paper mills
2631 Paperboard mills
2641 Paper coating and glazing
2642 Envelopes
2643 Bags, except textile bags
2645 Die cut paper and paperboard and cardboard
2646 Pressed and molded pulp goods
2647 Sanitary paper products
2648 Stationary, tablets and related products
2649 Converted paper and paperboard products, n.e.c.*
2651 Folding paperboard boxes
2652 Set-up paperboard boxes
2653 Corrugated and solid fiber boxes
2654 Sanitary food containers
2655 Fiber cans, tubes, drums, and similar products
2661 Building paper and building board mills

27 Printing, Publishing, and Allied Industries

2711 Newspapers: publishing, publishing and printing
2721 Periodicals: publishing, publishing and printing
2731 Books: publishing, publishing and printing
2732 Book printing
2741 Miscellaneous publishing
2751 Commercial printing, letterpress, and screen
2752 Commercial printing, lithographic
2753 Engraving and plate printing
2754 Commercial printing, gravure
2761 Manifold business forms
2771 Greeting card publishing
2782 Blankbooks, looseleaf binders and devices
2789 Bookbinding and related work
2791 Typesetting
2793 Photoengraving
2794 Electrotyping and stereotyping
2795 Lithographic plate-making and related services

28 Chemicals and Allied Products

2812 Alkalies and chlorine
2813 Industrial gases
2816 Inorganic pigments
2819 Industrial inorganic chemicals, n.e.c.*
2821 Plastics materials, synthetic resins, and non-vulcanizable elastomers
2822 Synthetic rubber (vulcanizable elastomers)
2823 Cellulosic man-made fibers
2824 Synthetic organic fibers, except cellulosic
2831 Biological products
2833 Medicinal chemicals and botanical products
2834 Pharmaceutical preparations
2841 Soap and other detergents except specialty cleaners
2842 Specialty cleaning, polishing, and sanitation preparations
2843 Surface active agents, finishing agents, sulfonated oils and assistants
2844 Perfumes, cosmetics, and other toilet preparations
2851 Paints, varnishes, lacquers, enamels, and allied products
2861 Gum and wood chemicals
2865 Cyclic (coal tar) crudes, and cyclic intermediates, dyes, and organic pigments (lakes and toners)
2869 Industrial organic chemicals, n.e.c.*
2873 Nitrogenous fertilizers
2874 Phosphatic fertilizers
2875 Fertilizers, mixing only
2879 Pesticides, and agricultural chemicals, n.e.c.*
2891 Adhesives and sealants
2892 Explosives
2893 Printing ink
2895 Carbon black
2899 Chemical and chemical preparations, n.e.c.*

29 Petroleum Refining and Related Industries

2911 Petroleum refining
2951 Paving mixtures and blocks
2952 Asphalt felts and coatings
2992 Lubricating oils and greases
2999 Products of petroleum and coal, n.e.c.*

30 Rubber and Miscellaneous Plastics Products

3011 Tires and inner tubes
3021 Rubber and plastic footwear
3031 Reclaimed rubber
3041 Rubber and plastic hose and belting
3069 Fabricated rubber products, n.e.c.*
3079 Miscellaneous plastics products

31 Leather and Leather Products

3111 Leather tanning and finishing
3131 Boot and shoe cut stock and findings
3142 House slippers
3143 Men's footwear, except athletic
3144 Women's footwear, except athletic
3149 Footwear, except rubber, n.e.c.*
3151 Leather gloves and mittens
3161 Luggage
3171 Women's handbags and purses
3172 Personal leather goods, except women's handbags and purses
3199 Leather goods, n.e.c.*

32 Stone, Clay, Glass and Concrete Products

3211 Flat glass
3221 Glass containers
3229 Pressed and blown glass and glassware, n.e.c.*
3231 Glass products, made of purchased glass
3241 Cement, hydraulic
3251 Brick and structural clay tile
3253 Ceramic wall and floor tile
3255 Clay refractories
3259 Structural clay products, n.e.c.*
3261 Vitreous china plumbing fixtures and china, and earthenware fittings and bathroom accessories
3262 Vitreous china table and kitchen articles
3263 Fine earthenware (whitewear) table and kitchen articles
3264 Porcelain electrical supplies
3269 Pottery products, n.e.c.*
3271 Concrete block and brick
3272 Concrete products, except block and brick
3273 Ready mixed concrete
3274 Lime
3275 Gypsum products
3281 Cut stone and stone products
3291 Abrasive products
3292 Asbestos products
3293 Gaskets, packing and sealing devices
3295 Minerals and earths, ground or otherwise treated
3296 Mineral wool
3297 Nonclay refractories
3299 Nonmetallic mineral products, n.e.c.*

33 Primary Metal Industries

3312 Blast furnaces (including coke ovens), steel works, and rolling mills
3313 Electrometallurgical products
3315 Steel wire drawing and steel nails and spikes
3316 Cold rolled steel sheet, strip and bars
3317 Steel pipe and tubes
3321 Gray iron foundries
3322 Malleable iron foundries
3324 Steel investment foundries
3325 Steel foundries, n.e.c.*
3331 Primary smelting and refining of copper
3332 Primary smelting and refining of lead
3333 Primary smelting and refining of zinc
3334 Primary production of aluminum
3339 Primary smelting and refining of nonferrous metals, n.e.c.*
3341 Secondary smelting and refining of nonferrous metals
3351 Rolling, drawing, and extruding of copper
3353 Aluminum sheet, plate, and foil
3354 Aluminum extruded products
3355 Aluminum rolling and drawing, n.e.c.*
3356 Rolling, drawing, and extruding of nonferrous metals, except copper and aluminum
3357 Drawing and insulating of nonferrous wire
3361 Aluminum foundries (castings)
3362 Brass, bronze, copper, copper base alloy foundries (castings)
3369 Nonferrous foundries (castings), n.e.c.*
3398 Metal heat treating
3399 Primary metal products, n.e.c.*

34 Fabricated Metal Products, except Machinery and Transportation Equipment

3411 Metal cans
3412 Metal shipping barrels, drums, kegs, pails
3421 Cutlery
3423 Hand and edge tools, except machine tools and hand saws
3425 Hand saws and saw blades
3429 Hardware, n.e.c.*
3431 Enameled iron and metal sanitary ware
3432 Plumbing fixture fittings and trim (brass goods)
3433 Heating equipment, except electric and warm air furnaces
3441 Fabricated structural metal
3442 Metal doors, sash, frames, molding and trim
3443 Fabricated plate work (boiler shops)
3444 Sheet metal work
3446 Architectural and ornamental metal work
3448 Prefabricated metal buildings and components
3449 Miscellaneous metal work
3451 Screw machine products
3452 Bolts, nuts, screws, rivets and washers
3462 Iron and steel forgings
3463 Nonferrous forgings
3465 Automotive stampings
3466 Crowns and closures
3469 Metal stampings, n.e.c.*
3471 Electroplating, plating, polishing, anodizing and coloring
3479 Coating, engraving and allied services, n.e.c.*
3482 Small arms ammunition
3483 Ammunition, except for small arms, n.e.c.*
3484 Small arms
3489 Ordnance and accessories, n.e.c.*
3493 Steel springs, except wire
3494 Valves and pipe fittings, except plumbers' brass goods
3495 Wire springs
3496 Miscellaneous fabricated wire products
3497 Metal foil and leaf
3498 Fabricated pipe and fabricated pipe fittings
3499 Fabricated metal products, n.e.c.*

35 Machinery, except Electrical

3511 Steam, gas and hydraulic turbines and turbine generator set units
3519 Internal combustion engines, n.e.c.*
3523 Farm machinery and equipment
3524 Garden tractors and lawn and garden equipment
3531 Construction machinery and equipment
3532 Mining machinery and equipment, except oil field machinery and equipment
3533 Oil field machinery and equipment
3534 Elevators and moving stairways
3535 Conveyors and conveying equipment
3536 Hoists, industrial cranes and monorail systems
3537 Industrial trucks, tractors, trailers and stackers
3541 Machine tools, metal cutting types
3542 Machine tools, metal forming types
3544 Special dies and tools, die sets, jigs and fixtures and industrial molds
3545 Machine tool accessories and measuring devices
3546 Power driven hand tools
3547 Rolling mill machinery and equipment
3549 Metalworking machinery, n.e.c.*
3551 Food products machinery
3552 Textile machinery
3553 Woodworking machinery
3554 Paper industries machinery
3555 Printing trades machinery and equipment
3559 Special industry machinery, n.e.c.*
3561 Pumps and pumping equipment
3562 Ball and roller bearings
3563 Air and gas compressors
3564 Blowers and exhaust and ventilation fans
3565 Industrial patterns
3566 Speed changers, industrial high speed drives and gears
3567 Industrial process furnaces and ovens
3568 Mechanical power transmission equipment, n.e.c.*
3569 General industrial machinery and equipment, n.e.c.*
3572 Typewriters
3573 Electronic computing equipment
3574 Calculating and accounting machines, except electronic computing equipment
3576 Scales and balances, except laboratory
3579 Office machines, n.e.c.*
3581 Automatic merchandising machines
3582 Commercial laundry, dry cleaning and pressing machines
3585 Air conditioning and warm air heating equipment and commercial and industrial refrigeration equipment
3586 Measuring and dispensing pumps
3589 Service industry machines, n.e.c.*
3592 Carburetors, pistons, piston rings and valves
3599 Machinery, except electrical, n.e.c.*

36 Electrical and Electronic Machinery, Equipment and Supplies

3612 Power, distribution and specialty transformers
3613 Switchgear and switchboard apparatus
3621 Motor and generators
3622 Industrial controls
3623 Welding apparatus, electric
3624 Carbon and graphite products
3629 Electrical industrial appliances, n.e.c.*
3631 Household cooking equipment
3632 Household refrigerators and home and farm freezers
3633 Household laundry equipment
3634 Electrical housewares and fans
3635 Household vacuum cleaners
3636 Sewing machines
3639 Household appliances, n.e.c.*
3641 Electric lamps
3643 Current carrying wiring devices
3644 Noncurrent carrying wiring devices
3645 Residential electric lighting fixtures
3646 Commercial, industrial and institutional electric lighting fixtures
3647 Vehicular lighting equipment
3648 Lighting equipment, n.e.c.*
3651 Radio and television receiving sets, except communication types
3652 Phonograph records and pre-recorded magnetic tape
3661 Telephone and telegraph apparatus
3662 Radio and television transmitting, signaling and detection equipment and apparatus
3671 Radio and television receiving type electron tubes, except cathode ray
3672 Cathode ray television picture tubes
3673 Transmitting, industrial and special purpose electron tubes
3674 Semiconductors and related devices
3675 Electronic capacitors
3676 Resistors, for electronic applications
3677 Electronic coils, transformers and other inductors
3678 Connectors, for electronic applications
3679 Electronic components, n.e.c.*
3691 Storage batteries
3692 Primary batteries, dry and wet
3693 Radiographic X-ray, fluoroscopic X-ray, therapeutic X-ray and other X-ray apparatus and tubes; electromedical and electrotherapeutic apparatus
3694 Electric equipment for internal combustion engines
3699 Electric machinery, equipment and supplies, n.e.c.*

37 Transportation Equipment

3711 Motor vehicles and passenger car bodies
3713 Truck and bus bodies
3714 Motor vehicle parts and accessories
3715 Truck trailers
3716 Motor homes
3721 Aircraft
3724 Aircraft engines and engine parts
3728 Aircraft parts and auxiliary equipment, n.e.c.*
3731 Ship building and repairing
3732 Boat building and repairing
3743 Railroad equipment
3751 Motorcycles, bicycles and parts
3761 Guided missiles and space vehicles
3764 Guided missile and space vehicle propulsion units and propulsion unit parts
3769 Guided missile and space vehicle parts and auxiliary equipment, n.e.c.*
3792 Travel trailers and campers
3795 Tanks and tank components
3799 Transportation equipment, n.e.c.*

38 Measuring, Analyzing and Controlling Instruments; Photographic, Medical and Optical Goods; Watches and Clocks

3811 Engineering, laboratory, scientific and research instruments and associated equipment

3822 Automatic controls for regulating residential and commercial environments and appliances
3823 Industrial instruments for measurement, display and control of process variables; and related products
3824 Totalizing fluid meters and counting devices
3825 Instruments for measuring and testing of electricity and electrical signals
3829 Measuring and controlling devices, n.e.c.*
3832 Optical instruments and lenses
3841 Surgical and medical instruments and apparatus
3842 Orthopedic, prosthetic and surgical appliances and supplies
3843 Dental equipment and supplies
3851 Ophthalmic goods
3861 Photographic equipment and supplies
3873 Watches, clocks, clockwork, operated devices and parts

39 Miscellaneous Manufacturing Industries

3911 Jewelry, precious metal
3914 Silverware, platedware and stainless steelware
3915 Jewelers' findings and materials and lapidary work
3931 Musical instruments
3942 Dolls
3944 Games, toys and children's vehicles; except dolls and bicycles
3949 Sporting and athletic goods, n.e.c.*
3951 Pens, mechanical pencils and parts
3952 Lead pencils, crayons and artists' materials
3953 Marking devices
3955 Carbon paper and inked ribbons
3961 Costume jewelry and costume novelties, except precious metal
3962 Feathers, plumes and artificial trees and flowers
3963 Buttons
3964 Needles, pins, hooks and eyes and similar notions
3991 Brooms and brushes
3993 Signs and advertising displays
3995 Burial caskets
3996 Linoleum, asphalted-felt-base and other hard surface floor coverings, n.e.c.*
3999 Manufacturing industries, n.e.c.*

*"Not elsewhere classified" indicated by "n.e.c."

TABLE II

TREATMENT CODES

[Note: These codes apply to only on-site treatment. See Section 6C of the instructions for off-site treatment codes.]

AIR EMISSIONS TREATMENT

A01 Flare
A02 Condenser
A03 Scrubber
A04 Absorber
A05 Electrostatic Precipitator
A06 Mechanical Separation
A07 Other Air Emission Treatment

BIOLOGICAL TREATMENT

B11 Biological Treatment -- Aerobic
B21 Biological Treatment -- Anaerobic
B31 Biological Treatment -- Facultative
B99 Biological Treatment -- Other

CHEMICAL TREATMENT

C01 Chemical Precipitation -- Lime or Sodium Hydroxide
C02 Chemical Precipitation -- Sulfide
C09 Chemical Precipitation -- Other
C11 Neutralization
C21 Chromium Reduction
C31 Complexed Metals Treatment (other than pH Adjustment)
C41 Cyanide Oxidation -- Alkaline Chlorination
C42 Cyanide Oxidation -- Electrochemical
C43 Cyanide Oxidation -- Other
C44 General Oxidation (including Disinfection) -- Chlorination
C45 General Oxidation (including Disinfection) -- Ozonation
C46 General Oxidation (including Disinfection) -- Ozonation
C99 Other Chemical Treatment

INCINERATION/THERMAL TREATMENT

F01 Liquid Injection
F11 Rotary Kiln with Liquid Injection Unit
F19 Other Rotary Kiln
F31 Two Stage
F41 Fixed Hearth
F42 Multiple Hearth
F51 Fluidized Bed
F61 Infra-Red
F71 Fume/Vapor
F81 Pyrolytic Destructor
F82 Wet Air Oxidation
F83 Thermal Drying/Dewatering
F99 Other Incineration/Thermal Treatment

PHYSICAL TREATMENT

P01 Equalization
P09 Other Blending
P11 Settling/Clarification
P12 Filtration
P13 Sludge Dewatering (non-thermal)
P14 Air Flotation
P15 Oil Skimming
P16 Emulsion Breaking -- Thermal
P17 Emulsion Breaking -- Chemical
P18 Emulsion Breaking -- Other
P19 Other Liquid Phase Separation
P21 Adsorption -- Carbon
P22 Adsorption -- Ion Exchange (other than for recovery/reuse)
P23 Adsorption -- Resin
P29 Adsorption -- Other
P31 Reverse Osmosis (other than for recovery/reuse)
P41 Stripping -- Air
P42 Stripping -- Steam
P49 Stripping -- Other
P51 Acid Leaching (other than for recovery/reuse)
P61 Solvent Extraction (other than recovery/reuse)
P99 Other Physical Treatment

RECOVERY/REUSE

R01 Reuse as Fuel -- Industrial Kiln
R02 Reuse as Fuel -- Industrial Furnace
R03 Reuse as Fuel -- Boiler
R04 Reuse as Fuel -- Fuel Blending
R09 Reuse as Fuel -- Other
R11 Solvents/Organics Recovery -- Batch Still Distillation
R12 Solvents/Organics Recovery -- Thin-Film Evaporation
R13 Solvents/Organics Recovery -- Fractionation
R14 Solvents/Organics Recovery -- Solvent Extraction
R19 Solvents/Organics Recovery -- Other
R21 Metals Recovery -- Electrolytic
R22 Metals Recovery -- Ion Exchange
R23 Metals Recovery -- Acid Leaching
R24 Metals Recovery -- Reverse Osmosis
R26 Metals Recovery -- Solvent Extraction
R29 Metals Recovery -- Other
R99 Other Reuse or Recovery

SOLIDIFICATION/STABILIZATION

G01 Cement Processes (including Silicates)
G09 Other Pozzolonic Processes (including Silicates)
G11 Asphaltic Processes
G21 Thermoplastic Techniques
G99 Other Solidification Processes

TABLE III

SECTION 313 TOXIC CHEMICAL LIST
(Including Chemical Categories)

[Note: Chemicals may be added or deleted to the list. The Emergency Planning and Community Right-to-Know Hotline, (800) 535-0202 or (202) 479-2449 in Washington, D.C. or Alaska, will provide up-to-date information on the status of these changes.]

a. Alphabetical List (Effective Date January 1, 1987)

CAS Number	Chemical Name
75-07-0	Acetaldehyde
60-35-5	Acetamide
67-64-1	Acetone
75-05-8	Acetonitrile
53-96-3	2-Acetylaminofluorene
107-02-8	Acrolein
79-06-1	Acrylamide
79-10-7	Acrylic acid
107-13-1	Acrylonitrile
309-00-2	Aldrin [1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a, 5,8,8a-hexahydro-(1.alpha., 4.alpha.,4a.beta.,5.alpha., 8.alpha.,8a.beta.)-]
107-05-1	Allyl chloride
7429-90-5	Aluminum (fume or dust)
1344-28-1	Aluminum oxide
117-79-3	2-Aminoanthraquinone
60-09-3	4-Aminoazobenzene
92-67-1	4-Aminobiphenyl
82-28-0	1-Amino-2-methylanthraquinone
7664-41-7	Ammonia
6484-52-2	Ammonium nitrate (solution)
7783-20-2	Ammonium sulfate (solution)
62-53-3	Aniline
90-04-0	o-Anisidine
104-94-9	p-Anisidine
134-29-2	o-Anisidine hydrochloride
120-12-7	Anthracene
7440-36-0	Antimony
7440-38-2	Arsenic
1332-21-4	Asbestos (friable)
7440-39-3	Barium
98-87-3	Benzal chloride
55-21-0	Benzamide
71-43-2	Benzene
92-87-5	Benzidine
98-07-7	Benzoic trichloride (Benzotrichloride)
98-88-4	Benzoyl chloride
94-36-0	Benzoyl peroxide
100-44-7	Benzyl chloride
7440-41-7	Beryllium
92-52-4	Biphenyl
111-44-4	Bis(2-chloroethyl) ether
542-88-1	Bis(chloromethyl) ether
108-60-1	Bis(2-chloro-1-methylethyl) ether
103-23-1	Bis(2-ethylhexyl) adipate
75-25-2	Bromoform (Tribromomethane)
74-83-9	Bromomethane (Methyl bromide)
106-99-0	1,3-Butadiene
141-32-2	Butyl acrylate
71-36-3	n-Butyl alcohol
78-92-2	sec-Butyl alcohol
75-65-0	tert-Butyl alcohol
85-68-7	Butyl benzyl phthalate
106-88-7	1,2-Butylene oxide
123-72-8	Butyraldehyde
2650-18-2	C.I. Acid Blue 9, diammonium salt
3844-45-9	C.I. Acid Blue 9, disodium salt
4680-78-8	C.I. Acid Green 3
569-64-2	C.I. Basic Green 4
989-38-8	C.I. Basic Red 1
1937-37-7	C.I. Direct Black 38
2602-46-2	C.I. Direct Blue 6
16071-86-6	C.I. Direct Brown 95
2832-40-8	C.I. Disperse Yellow 3
3761-53-3	C.I. Food Red 5
81-88-9	C.I. Food Red 15
3118-97-6	C.I. Solvent Orange 7
97-56-3	C.I. Solvent Yellow 3
842-07-9	C.I. Solvent Yellow 14
492-80-8	C.I. Solvent Yellow 34 (Auramine)
128-66-5	C.I. Vat Yellow 4
7440-43-9	Cadmium
156-62-7	Calcium cyanamide
133-06-2	Captan [1H-Isoindole-1,3(2H)-dione, 3a,4,7,7a-tetrahydro-2-[(trichloromethyl)thio]-]
63-25-2	Carbaryl [1-Naphthalenol, methylcarbamate]
75-15-0	Carbon disulfide
56-23-5	Carbon tetrachloride
463-58-1	Carbonyl sulfide
120-80-9	Catechol
133-90-4	Chloramben [Benzoic acid, 3-amino-2,5-dichloro-]
57-74-9	Chlordane [4,7-Methanoindan, 1,2,4,5,6,7,8,8- octachloro-2,3,3a,4,7,7a-hexahydro-]
7782-50-5	Chlorine
10049-04-4	Chlorine dioxide
79-11-8	Chloroacetic acid
532-27-4	2-Chloroacetophenone
108-90-7	Chlorobenzene
510-15-6	Chlorobenzilate [Benzeneacetic acid, 4-chloro-.alpha.-(4-chlorophenyl)-.alpha.-hydroxy-, ethyl ester]
75-00-3	Chloroethane (Ethyl chloride)
67-66-3	Chloroform
74-87-3	Chloromethane (Methyl chloride)
107-30-2	Chloromethyl methyl ether
126-99-8	Chloroprene
1897-45-6	Chlorothalonil [1,3-Benzenedicarbonitrile, 2,4,5,6-tetrachloro-]
7440-47-3	Chromium
7440-48-4	Cobalt
7440-50-8	Copper
120-71-8	p-Cresidine
1319-77-3	Cresol (mixed isomers)
108-39-4	m-Cresol
95-48-7	o-Cresol
106-44-5	p-Cresol
98-82-8	Cumene
80-15-9	Cumene hydroperoxide
135-20-6	Cupferron [Benzeneamine, N-hydroxy-N-nitroso, ammonium salt]

110-82-7	Cyclohexane
94-75-7	2,4-D [Acetic acid, (2,4-dichlorophenoxy)-]
1163-19-5	Decabromodiphenyl oxide
2303-16-4	Diallate [Carbamothioic acid,bis(1-methylethyl)-, S-(2,3-dichloro-2-propenyl) ester]
615-05-4	2,4-Diaminoanisole
39156-41-7	2,4-Diaminoanisole sulfate
101-80-4	4,4'-Diaminodiphenyl ether
25376-45-8	Diaminotoluene (mixed isomers)
95-80-7	2,4-Diaminotoluene
334-88-3	Diazomethane
132-64-9	Dibenzofuran
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)
106-93-4	1,2-Dibromoethane (Ethylene dibromide)
84-74-2	Dibutyl phthalate
25321-22-6	Dichlorobenzene (mixed isomers)
95-50-1	1,2-Dichlorobenzene
541-73-1	1,3-Dichlorobenzene
106-46-7	1,4-Dichlorobenzene
91-94-1	3,3'-Dichlorobenzidine
75-27-4	Dichlorobromomethane
107-06-2	1,2-Dichloroethane (Ethylene dichloride)
540-59-0	1,2-Dichloroethylene
75-09-2	Dichloromethane (Methylene chloride)
120-83-2	2,4-Dichlorophenol
78-87-5	1,2-Dichloropropane
542-75-6	1,3-Dichloropropylene
62-73-7	Dichlorvos [Phosphoric acid, 2 dichloroethenyl dimethyl ester]
115-32-2	Dicofol [Benzenemethanol, 4-chloro-.alpha.- 4-chlorophenyl)-.alpha.- (trichloromethyl)-]
1464-53-5	Diepoxybutane
111-42-2	Diethanolamine
117-81-7	Di-(2-ethylhexyl) phthalate (DEHP)
84-66-2	Diethyl phthalate
64-67-5	Diethyl sulfate
119-90-4	3,3'-Dimethoxybenzidine
60-11-7	4-Dimethylaminoazobenzene
119-93-7	3,3'-Dimethylbenzidine (o-Tolidine)
79-44-7	Dimethylcarbamyl chloride
57-14-7	1,1-Dimethyl hydrazine
105-67-9	2,4-Dimethylphenol
131-11-3	Dimethyl phthalate
77-78-1	Dimethyl sulfate
534-52-1	4,6-Dinitro-o-cresol
51-28-5	2,4-Dinitrophenol
121-14-2	2,4-Dinitrotoluene
606-20-2	2,6-Dinitrotoluene
117-84-0	n-Dioctyl phthalate
123-91-1	1,4-Dioxane
122-66-7	1,2-Diphenylhydrazine (Hydrazobenzene)
106-89-8	Epichlorohydrin
110-80-5	2-Ethoxyethanol
140-88-5	Ethyl acrylate
100-41-4	Ethylbenzene
541-41-3	Ethyl chloroformate
74-85-1	Ethylene
107-21-1	Ethylene glycol
151-56-4	Ethyleneimine (Aziridine)
75-21-8	Ethylene oxide
96-45-7	Ethylene thiourea
2164-17-2	Fluometuron [Urea, N,N-dimethyl-N'-[3-(trifluoromethyl)phenyl]-]
50-00-0	Formaldehyde
76-13-1	Freon 113 [Ethane, 1,1,2-trichloro-1,2,2-trifluoro-]
76-44-8	Heptachlor [1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methano-1H-indene]
118-74-1	Hexachlorobenzene
87-68-3	Hexachloro-1,3-butadiene
77-47-4	Hexachlorocyclopentadiene
67-72-1	Hexachloroethane
1335-87-1	Hexachloronaphthalene
680-31-9	Hexamethylphosphoramide
302-01-2	Hydrazine
10034-93-2	Hydrazine sulfate
7647-01-0	Hydrochloric acid
74-90-8	Hydrogen cyanide
7664-39-3	Hydrogen fluoride
123-31-9	Hydroquinone
78-84-2	Isobutyraldehyde
67-63-0	Isopropyl alcohol (manufacturing-strong acid process, no supplier notification)
80-05-7	4,4'-Isopropylidenediphenol
7439-92-1	Lead
58-89-9	Lindane[Cyclohexane, 1,2,3,4,5,6-hexachloro-,(1.alpha.,2.alpha.,3.beta.,4.alpha.,5.alpha.,6.beta.)-]
108-31-6	Maleic anhydride
12427-38-2	Maneb [Carbamodithioic acid, 1,2-ethanediylbis-, manganese complex]
7439-96-5	Manganese
108-78-1	Melamine
7439-97-6	Mercury
67-56-1	Methanol
72-43-5	Methoxychlor [Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4-methoxy-]
109-86-4	2-Methoxyethanol
96-33-3	Methyl acrylate
1634-04-4	Methyl tert-butyl ether
101-14-4	4,4'-Methylenebis(2-chloro aniline) (MBOCA)
101-61-1	4,4'-Methylenebis(N,N-dimethyl) benzenamine
101-68-8	Methylenebis(phenylisocyanate) (MBI)
74-95-3	Methylene bromide
101-77-9	4,4'-Methylenedianiline
78-93-3	Methyl ethyl ketone
60-34-4	Methyl hydrazine
74-88-4	Methyl iodide
108-10-1	Methyl isobutyl ketone
624-83-9	Methyl isocyanate
80-62-6	Methyl methacrylate
90-94-8	Michler's ketone
1313-27-5	Molybdenum trioxide
505-60-2	Mustard gas [Ethane, 1,1'-tahiobis[2-chloro-]
91-20-3	Naphthalene
134-32-7	alpha-Naphthylamine
91-59-8	beta-Naphthylamine
7440-02-0	Nickel
7697-37-2	Nitric acid
139-13-9	Nitrilotriacetic acid
99-59-2	5-Nitro-o-anisidine
98-95-3	Nitrobenzene
92-93-3	4-Nitrobiphenyl
1836-75-5	Nitrofen [Benzene, 2,4-dichloro-1-(4-nitrophenoxy)-]
51-75-2	Nitrogen mustard [2-Chloro-N-(2-chloroethyl) -N-methylethanamine]
55-63-0	Nitroglycerin
88-75-5	2-Nitrophenol
100-02-7	4-Nitrophenol

79-46-9	2-Nitropropane
156-10-5	p-Nitrosodiphenylamine
121-69-7	N,N-Dimethylaniline
924-16-3	N-Nitrosodi-n-butylamine
55-18-5	N-Nitrosodiethylamine
62-75-9	N-Nitrosodimethylamine
86-30-6	N-Nitrosodiphenylamine
621-64-7	N-Nitrosodi-n-propylamine
4549-40-0	N-Nitrosomethylvinylamine
59-89-2	N-Nitrosomorpholine
759-73-9	N-Nitroso-N-ethylurea
684-93-5	N-Nitroso-N-methylurea
16543-55-8	N-Nitrosonornicotine
100-75-4	N-Nitrosopiperidine
2234-13-1	Octachloronaphthalene
20816-12-0	Osmium tetroxide
56-38-2	Parathion [Phosphorothioic acid, 0, 0-diethyl-0-(4-nitrophenyl) ester]
87-86-5	Pentachlorophenol (PCP)
79-21-0	Peracetic acid
108-95-2	Phenol
106-50-3	p-Phenylenediamine
90-43-7	2-Phenylphenol
75-44-5	Phosgene
7664-38-2	Phosphoric acid
7723-14-0	Phosphorus (yellow or white)
85-44-9	Phthalic anhydride
88-89-1	Picric acid
1336-36-3	Polychlorinated biphenyls (PCBs)
1120-71-4	Propane sultone
57-57-8	beta-Propiolactone
123-38-6	Propionaldehyde
114-26-1	Propoxur [Phenol, 2-(1-methylethoxy)-, methylcarbamate]
115-07-1	Propylene (Propene)
75-55-8	Propyleneimine
75-56-9	Propylene oxide
110-86-1	Pyridine
91-22-5	Quinoline
106-51-4	Quinone
82-68-8	Quintozene [Pentachloronitrobenzene]
81-07-2	Saccharin (manufacturing, no supplier notification) [1,2-Benzisothiazol -3(2H)-one, 1,1-dioxide]
94-59-7	Safrole
7782-49-2	Selenium
7440-22-4	Silver
1310-73-2	Sodium hydroxide (solution)
7757-82-6	Sodium sulfate (solution)
100-42-5	Styrene
96-09-3	Styrene oxide
7664-93-9	Sulfuric acid
100-21-0	Terephthalic acid
79-34-5	1,1,2,2-Tetrachloroethane
127-18-4	Tetrachloroethylene (Perchloroethylene)
961-11-5	Tetrachlorvinphos [Phosphoric acid, 2-chloro-1- (2,3,5-trichlorophenyl)ethenyl dimethyl ester]
7440-28-0	Thallium
62-55-5	Thioacetamide
139-65-1	4,4'-Thiodianiline
62-56-6	Thiourea
1314-20-1	Thorium dioxide
13463-67-7	Titanium dioxide
7550-45-0	Titanium tetrachloride
108-88-3	Toluene
584-84-9	Toluene-2,4-diisocyanate
91-08-7	Toluene-2,6-diisocyanate
95-53-4	o-Toluidine
636-21-5	o-Toluidine hydrochloride
8001-35-2	Toxaphene
68-76-8	Triaziquone [2,5-Cyclohexadiene-1,4-dione, 2,3,5-tris(1-aziridinyl)-]
52-68-6	Trichlorfon [Phosphonic acid, (2,2,2-trichloro-1-hydroxyethyl)-, dimethyl ester]
120-82-1	1,2,4-Trichlorobenzene
71-55-6	1,1,1-Trichloroethane (Methyl chloroform)
79-00-5	1,1,2-Trichloroethane
79-01-6	Trichloroethylene
95-95-4	2,4,5-Trichlorophenol
88-06-2	2,4,6-Trichlorophenol
1582-09-8	Trifluralin [Benzeneamine, 2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)-]
95-63-6	1,2,4-Trimethylbenzene
126-72-7	Tris(2,3-dibromopropyl) phosphate
51-79-6	Urethane (Ethyl carbamate)
7440-62-2	Vanadium (fume or dust)
108-05-4	Vinyl acetate
593-60-2	Vinyl bromide
75-01-4	Vinyl chloride
75-35-4	Vinylidene chloride
1330-20-7	Xylene (mixed isomers)
108-38-3	m-Xylene
95-47-6	o-Xylene
106-42-3	p-Xylene
87-62-7	2,6-Xylidine
7440-66-6	Zinc (fume or dust)
12122-67-7	Zineb [Carbamodithioic acid, 1,2-ethanediylbis-, zinc complex]

b. List By CAS Number (Effective Date January 1, 1987)

CAS Number	Chemical Name
50-00-0	Formaldehyde
51-28-5	2,4-Dinitrophenol
51-75-2	Nitrogen mustard [2-Chloro-N-(2-chloroethyl)-N-methylanamine]
51-79-6	Urethane (Ethyl carbamate)
52-68-6	Trichlorfon [Phosphonic acid, (2,2,2-trichloro-1-hydroxyethyl)-dimethyl ester]
53-96-3	2-Acetylaminofluorene
55-18-5	N-Nitrosodiethylamine
55-21-0	Benzamide
55-63-0	Nitroglycerin
56-23-5	Carbon tetrachloride
56-38-2	Parathion [Phosphorothioic acid, O,O-diethyl-O-(4-nitrophenyl)ester]
57-14-7	1,1-Dimethyl hydrazine
57-57-8	beta-Propiolactone
57-74-9	Chlordane [4,7-Methanoindan, 1,2,4,5,6,7,8,8- octachloro-2,3,3a,4,7,7a-hexahydro-]
58-89-9	Lindane [Cyclohexane, 1,2,3,4,5,6-hexachloro-,(1.alpha., 2.alpha.,3.beta., 4.alpha.,5.alpha.,6.beta.)-]
59-89-2	N-Nitrosomorpholine
60-09-3	4-Aminoazobenzene
60-11-7	4-Dimethylaminoazobenzene
60-34-4	Methyl hydrazine
60-35-5	Acetamide
62-53-3	Aniline
62-55-5	Thioacetamide
62-56-6	Thiourea
62-73-7	Dichlorvos [Phosphoric acid, 2,2-dichloroethenyl dimethyl ester]

62-75-9	N-Nitrosodimethylamine
63-25-2	Carbaryl [1-Naphthalenol, methylcarbamate]
64-67-5	Diethyl sulfate
67-56-1	Methanol
67-63-0	Isopropyl alcohol(manufacturing-strong acid process, no supplier notification)
67-64-1	Acetone
67-66-3	Chloroform
67-72-1	Hexachloroethane
68-76-8	Triaziquone [2,5-Cyclohexadiene-1,4-dione, 2,3,5-tris(1-aziridinyl)-]
71-36-3	n-Butyl alcohol
71-43-2	Benzene
71-55-6	1,1,1-Trichloroethane (Methyl chloroform)
72-43-5	Methoxychlor [Benzene, 1,1'-(2,2,2-trichloroethylidene)bis [4-methoxy-]
74-83-9	Bromomethane (Methyl bromide)
74-85-1	Ethylene
74-87-3	Chloromethane (Methyl chloride)
74-88-4	Methyl iodide
74-90-8	Hydrogen cyanide
74-95-3	Methylene bromide
75-00-3	Chloroethane (Ethyl chloride)
75-01-4	Vinyl chloride
75-05-8	Acetonitrile
75-07-0	Acetaldehyde
75-09-2	Dichloromethane (Methylene chloride)
75-15-0	Carbon disulfide
75-21-8	Ethylene oxide
75-25-2	Bromoform (Tribromomethane)
75-27-4	Dichlorobromomethane
75-35-4	Vinylidene chloride
75-44-5	Phosgene
75-55-8	Propyleneimine
75-56-9	Propylene oxide
75-65-0	tert-Butyl alcohol
76-13-1	Freon 113 [Ethane, 1,1,2-trichloro-1,2,2-trifluoro-]
76-44-8	Heptachlor [1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methano-1H-indene]
77-47-4	Hexachlorocyclopentadiene
77-78-1	Dimethyl sulfate
78-84-2	Isobutyraldehyde
78-87-5	1,2-Dichloropropane
78-92-2	sec-Butyl alcohol
78-93-3	Methyl ethyl ketone
79-00-5	1,1,2-Trichloroethane
79-01-6	Trichloroethylene
79-06-1	Acrylamide
79-10-7	Acrylic acid
79-11-8	Chloroacetic acid
79-21-0	Peracetic acid
79-34-5	1,1,2,2-Tetrachloroethane
79-44-7	Dimethylcarbamyl chloride
79-46-9	2-Nitropropane
80-05-7	4,4'-Isopropylidenediphenol
80-15-9	Cumene hydroperoxide
80-62-6	Methyl methacrylate
81-07-2	Saccharin (manufacturing, no supplier notification) [1,2-Benzisothiazol-3(2H)-one, 1,1-dioxide]
81-88-9	C.I. Food Red 15
82-28-0	1-Amino-2-methylanthraquinone
82-68-8	Quintozene [Pentachloronitrobenzene]
84-66-2	Diethyl phthalate
84-74-2	Dibutyl phthalate
85-44-9	Phthalic anhydride
85-68-7	Butyl benzyl phthalate
86-30-6	N-Nitrosodiphenylamine
87-62-7	2,6-Xylidine
87-68-3	Hexachloro-1,3-butadiene
87-86-5	Pentachlorophenol (PCP)
88-06-2	2,4,6-Trichlorophenol
88-75-5	2-Nitrophenol
88-89-1	Picric acid
90-04-0	o-Anisidine
90-43-7	2-Phenylphenol
90-94-8	Michler's ketone
91-08-7	Toluene-2,6-diisocyanate
91-20-3	Naphthalene
91-22-5	Quinoline
91-59-8	beta-Naphthylamine
91-94-1	3,3'-Dichlorobenzidine
92-52-4	Biphenyl
92-67-1	4-Aminobiphenyl
92-87-5	Benzidine
92-93-3	4-Nitrobiphenyl
94-36-0	Benzoyl peroxide
94-59-7	Safrole
94-75-7	2,4-D [Acetic acid, (2,4-dichlorophenoxy)-]
95-47-6	o-Xylene
95-48-7	o-Cresol
95-50-1	1,2-Dichlorobenzene
95-53-4	o-Toluidine
95-63-6	1,2,4-Trimethylbenzene
95-80-7	2,4-Diaminotoluene
95-95-4	2,4,5-Trichlorophenol
96-09-3	Styrene oxide
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)
96-33-3	Methyl acrylate
96-45-7	Ethylene thiourea
97-56-3	C.I. Solvent Yellow 3
98-07-7	Benzoic trichloride (Benzotrichloride)
98-82-8	Cumene
98-87-3	Benzal chloride
98-88-4	Benzoyl chloride
98-95-3	Nitrobenzene
99-59-2	5-Nitro-o-anisidine
100-02-7	4-Nitrophenol
100-21-0	Terephthalic acid
100-41-4	Ethylbenzene
100-42-5	Styrene
100-44-7	Benzyl chloride
100-75-4	N-Nitrosopiperidine
101-14-4	4,4'-Methylenebis(2-chloroaniline) (MBOCA)
101-61-1	4,4'-Methylenebis(N,N-dimethyl) benzenamine
101-68-8	Methylenebis(phenylisocyanate) (MBI)
101-77-9	4,4'-Methylenedianiline
101-80-4	4,4'-Diaminodiphenyl ether
103-23-1	Bis(2-ethylhexyl) adipate
104-94-9	p-Anisidine
105-67-9	2,4-Dimethylphenol
106-42-3	p-Xylene
106-44-5	p-Cresol
106-46-7	1,4-Dichlorobenzene
106-50-3	p-Phenylenediamine
106-51-4	Quinone
106-88-7	1,2-Butylene oxide
106-89-8	Epichlorohydrin
106-93-4	1,2-Dibromoethane (Ethylene dibromide)
106-99-0	1,3-Butadiene
107-02-8	Acrolein
107-05-1	Allyl chloride
107-06-2	1,2-Dichloroethane (Ethylene dichloride)
107-13-1	Acrylonitrile
107-21-1	Ethylene glycol
107-30-2	Chloromethyl methyl ether
108-05-4	Vinyl acetate

108-10-1	Methyl isobutyl ketone
108-31-6	Maleic anhydride
108-38-3	m-Xylene
108-39-4	m-Cresol
108-60-1	Bis(2-chloro-1-methylethyl) ether
108-78-1	Melamine
108-88-3	Toluene
108-90-7	Chlorobenzene
108-95-2	Phenol
109-86-4	2-Methoxyethanol
110-80-5	2-Ethoxyethanol
110-82-7	Cyclohexane
110-86-1	Pyridine
111-42-2	Diethanolamine
111-44-4	Bis(2-chloroethyl) ether
114-26-1	Propoxur [Phenol, 2-(1-methylethoxy)-, methylcarbamate]
115-07-1	Propylene (Propene)
115-32-2	Dicofol [Benzenemethanol, 4-chloro-.alpha.-(4-chlorophenyl)-.alpha.-(trichloromethyl)-]
117-79-3	2-Aminoanthraquinone
117-81-7	Di(2-ethylhexyl) phthalate (DEHP)
117-84-0	n-Dioctyl phthalate
118-74-1	Hexachlorobenzene
119-90-4	3,3'-Dimethoxybenzidine
119-93-7	3,3'-Dimethylbenzidine (o-Tolidine)
120-12-7	Anthracene
120-71-8	p-Cresidine
120-80-9	Catechol
120-82-1	1,2,4-Trichlorobenzene
120-83-2	2,4-Dichlorophenol
121-14-2	2,4-Dinitrotoluene
121-69-7	N,N-Dimethylaniline
122-66-7	1,2-Diphenylhydrazine (Hydrazobenzene)
123-31-9	Hydroquinone
123-38-6	Propionaldehyde
123-72-8	Butyraldehyde
123-91-1	1,4-Dioxane
126-72-7	Tris(2,3-dibromopropyl) phosphate
126-99-8	Chloroprene
127-18-4	Tetrachloroethylene (Perchloroethylene)
128-66-5	C.I. Vat Yellow 4
131-11-3	Dimethyl phthalate
132-64-9	Dibenzofuran
133-06-2	Captan [1H-Isoindole-1,3(2H)-dione, 3a,4,7,7a-tetrahydro-2-[(trichloromethyl)thio]-]
133-90-4	Chloramben [Benzoic acid, 3-amino-2,5-dichloro-]
134-29-2	o-Anisidine hydrochloride
134-32-7	alpha-Naphthylamine
135-20-6	Cupferron [Benzeneamine, N-hydroxy-N-nitroso, ammonium salt]
139-13-9	Nitrilotriacetic acid
139-65-1	4,4'-Thiodianiline
140-88-5	Ethyl acrylate
141-32-2	Butyl acrylate
151-56-4	Ethyleneimine (Aziridine)
156-10-5	p-Nitrosodiphenylamine
156-62-7	Calcium cyanamide
302-01-2	Hydrazine
309-00-2	Aldrin [1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-(1.alpha.,4.alpha.,4a.beta.,5.alpha.,8.alpha.,8a.beta.)-]
334-88-3	Diazomethane
463-58-1	Carbonyl sulfide
492-80-8	C.I. Solvent Yellow 34 (Auramine)
505-60-2	Mustard gas [Ethane,1,1'-thiobis [2-chloro-]
510-15-6	Chlorobenzilate [Benzeneacetic acid, 4-chloro-.alpha.-(4-chlorophenyl)-.alpha.-hydroxy-,ehtyl ester]
532-27-4	2-Chloroacetophenone
534-52-1	4,6-Dinitro-o-cresol
540-59-0	1,2-Dichloroethylene
541-41-3	Ethyl chloroformate
541-73-1	1,3-Dichlorobenzene
542-75-6	1,3-Dichloropropylene
542-88-1	Bis(chloromethyl) ether
569-64-2	C.I. Basic Green 4
584-84-9	Toluene-2,4-diisocyanate
593-60-2	Vinyl bromide
606-20-2	2,6-Dinitrotoluene
615-05-4	2,4-Diaminoanisole
621-64-7	N-Nitrosodi-n-propylamine
624-83-9	Methyl isocyanate
636-21-5	o-Toluidine hydrochloride
680-31-9	Hexamethylphosphoramide
684-93-5	N-Nitroso-N-methylurea
759-73-9	N-Nitroso-N-ethylurea
842-07-9	C.I. Solvent Yellow 14
924-16-3	N-Nitrosodi-n-butylamine
961-11-5	Tetrachlorvinphos [Phosphoric acid, 2-chloro-1- (2,3,5-trichlorophenyl)ethenyl dimethyl ester]
989-38-8	C.I. Basic Red 1
1120-71-4	Propane sultone
1163-19-5	Decabromodiphenyl oxide
1310-73-2	Sodium hydroxide (solution)
1313-27-5	Molybdenum trioxide
1314-20-1	Thorium dioxide
1319-77-3	Cresol (mixed isomers)
1330-20-7	Xylene (mixed isomers)
1332-21-4	Asbestos (friable)
1335-87-1	Hexachloronaphthalene
1336-36-3	Polychlorinated biphenyls (PCBs)
1344-28-1	Aluminum oxide
1464-53-5	Diepoxybutane
1582-09-8	Trifluralin [Benzeneamine, 2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)-]
1634-04-4	Methyl tert-butyl ether
1836-75-5	Nitrofen [Benzene, 2,4-dichloro-1-(4-nitrophenoxy)-]
1897-45-6	Chlorothalonil [1,3-Benzenedicarbonitrile, 2,4,5,6-tetrachloro-]
1937-37-7	C.I. Direct Black 38
2164-17-2	Fluometuron [Urea, N,N-dimethyl-N'-[3-(trifluoromethyl)phenyl]-]
2234-13-1	Octachloronaphthalene
2303-16-4	Diallate [Carbamothioc acid, bis (1-methylethyl)-, S-(2,3-dichloro-2-propenyl) ester]
2602-46-2	C.I. Direct Blue 6
2650-18-2	C.I. Acid Blue 9, diammonium salt
2832-40-8	C.I. Disperse Yellow 3
3118-97-6	C.I. Solvent Orange 7
3761-53-3	C.I. Food Red 5
3844-45-9	C.I. Acid Blue 9, disodium salt
4549-40-0	N-Nitrosomethylvinylamine
4680-78-8	C.I. Acid Green 3
6484-52-2	Ammonium nitrate (solution)
7429-90-5	Aluminum (fume or dust)
7439-92-1	Lead
7439-96-5	Manganese
7439-97-6	Mercury
7440-02-0	Nickel
7440-22-4	Silver
7440-28-0	Thallium
7440-36-0	Antimony
7440-38-2	Arsenic

7440-39-3	Barium
7440-41-7	Beryllium
7440-43-9	Cadmium
7440-47-3	Chromium
7440-48-4	Cobalt
7440-50-8	Copper
7440-62-2	Vanadium (fume or dust)
7440-66-6	Zinc (fume or dust)
7550-45-0	Titanium tetrachloride
7647-01-0	Hydrochloric acid
7664-38-2	Phosphoric acid
7664-39-3	Hydrogen fluoride
7664-41-7	Ammonia
7664-93-9	Sulfuric acid
7697-37-2	Nitric acid
7723-14-0	Phosphorus (yellow or white)
7757-82-6	Sodium sulfate (solution)
7782-49-2	Selenium
7782-50-5	Chlorine
7783-20-2	Ammonium sulfate (solution)
8001-35-2	Toxaphene
10034-93-2	Hydrazine sulfate
10049-04-4	Chlorine dioxide
12122-67-7	Zineb [Carbamodithioic acid, 1,2-ethanediylbis-, zinc complex]
12427-38-2	Maneb [Carbamodithioic acid, 1,2-ethanediylbis-, manganese complex]
13463-67-7	Titanium dioxide
16071-86-6	C.I Direct Brown 95
16543-55-8	N-Nitrosonornicotine
20816-12-0	Osmium tetroxide
25321-22-6	Dichlorobenzene (mixed isomers)
25376-45-8	Diaminotoluene (mixed isomers)
39156-41-7	2,4-Diaminoanisole sulfate

c. Chemical Categories (Effective Date January 1, 1987)

Antimony Compounds - Includes any unique chemical substance that contains antimony as part of that chemical's infrastructure.

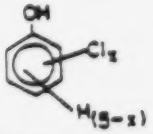
Arsenic Compounds - Includes any unique chemical substance that contains arsenic as part of that chemical's infrastructure.

Barium Compounds - Includes any unique chemical substance that contains bariumas part of that chemical's infrastructure.

Beryllium Compounds - Includes any unique chemical substance that contains beryllium as part of that chemical's infrastructure.

Cadmium Compounds - Includes any unique chemical substance that contains cadmium as part of that chemical's infrastructure.

Chlorophenols -



where x = 1 to 5

Chromium Compounds - Includes any unique chemical substance that contains chromium as part of that chemical's infrastructure.

Cobalt Compounds - Includes any unique chemical substance that contains cobalt as part of that chemical's infrastructure.

Copper Compounds - Includes any unique chemical substance that contains copper as part of that chemical's infrastructure.

Cyanide Compounds - $X^+ CN^-$ where $X = H^+$ or any other group where a formal dissociation can be made. For example KCN or $Ca(CN)_2$.

Glycol Ethers - Includes mono- and di- ethers of ethylene glycol, diethylene glycol, and triethylene glycol.

$R\text{-}(OCH_2CH_2)_n\text{-}OR'$

Where n = 1,2,or 3

R = alkyl or aryl groups

R'= R, H, or groups which, when removed, yield glycol ethers with the structure:

$R\text{-}(OCH_2CH_2)_n\text{-}OH$

Polymers are excluded from this category.

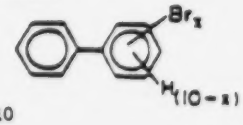
Lead Compounds - Includes any unique chemical substance that contains lead as part of that chemical's infrastructure.

Manganese Compounds - Includes any unique chemical substance that contains manganese as part of that chemical's infrastructure.

Mercury Compounds - Includes any unique chemical substance that contains mercury as part of that chemical's infrastructure.

Nickel Compounds - Includes any unique chemical substance that contains nickel as part of that chemical's infrastructure.

Polybrominated Biphenyls (PBBs)



where x = 1 to 10

Selenium Compounds - Includes any unique chemical substance that contains selenium as part of that chemical's infrastructure.

Silver Compounds - Includes any unique chemical substance that contains silver as part of that chemical's infrastructure.

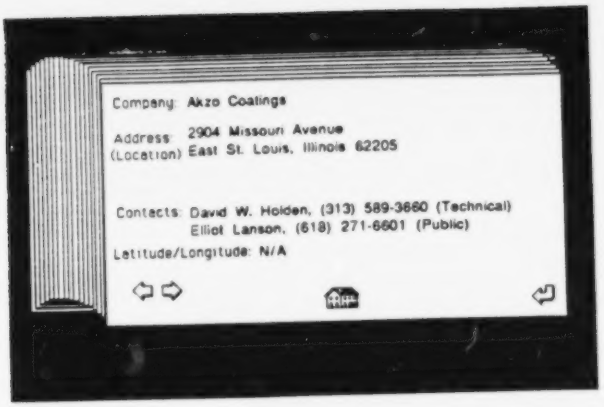
Thallium Compounds - Includes any unique chemical substance that contains thallium as part of that chemical's infrastructure.

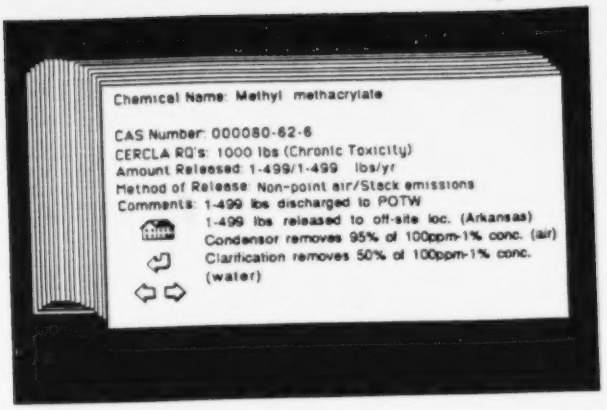
Zinc Compounds - Includes any unique chemical substance that contains zinc as part of that chemical's infrastructure.

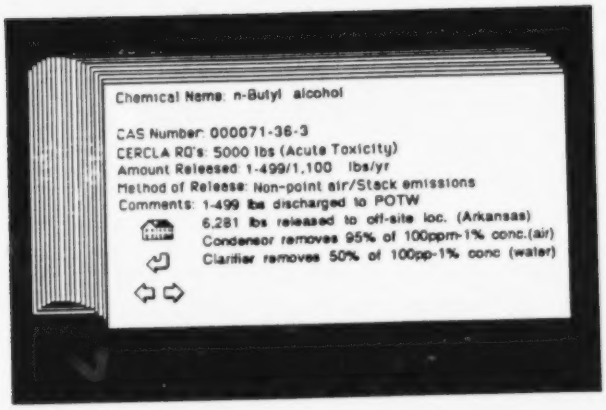
CAS Number	Chemicals	CERCLA RQ's	Companies
000050-00-0	Formaldehyde	10 (PC)	Excelsior Foundry Co.
000062-53-3	Aniline	1000 (AQTX,Acute)	Monsanto
000067-56-1	Methanol	5000 (AQTX,Acute)	Ethyl Petroleum
000071-43-2	Benzene	10 (PC)	Ethyl Petroleum, Monsanto
000071-55-6	1,1,1 Trichloroethane	1000 (CTX)	Cerro Copper
000075-09-2	Dichloromethane	1000 (CTX)	Cerro Copper
000075-65-0	tert-Butyl Alcohol		Ethyl Petroleum
000078-93-3	Methyl Ethyl Ketone	1000 (CTX)	Monsanto
000079-01-6	Trichloroethylene	1000(AQTX) 100(PC)	Cerro Copper
000080-62-6	Methyl Methacrylate	1000 (CTX)	Akzo Coatings
000088-75-5	2 Nitrophenol	5000(Acute) 100(AQTX)	Monsanto
000091-20-3	Napthalene	5000(Acute) 100(AQTX)	Ethyl Petroleum
000094-75-7	2,4-D	1000(Acute,CTX) 100(AQTX)	Kaiser-Estech
000095-50-1	1,2 Dichlorobenzene	1000(CTX) 100(AQTX)	Monsanto
000100-02-7	4-Nitrophenol	5000(Acute) 100(AQTX)	Monsanto
000100-41-4	Ethyl Benzene	5000(Acute,CTX) 1000 (AQTX)	Monsanto, Akzo Coatings
000100-42-5	Styrene	5000(Acute) 1000(AQTX)	Ethyl Petroleum
000101-68-8	Methylene bis(phenylisocyanate)		Excelsior Foundry Co.
000106-46-7	1,4 Dichlorobenzene	1000(CTX) 100(AQTX)	Monsanto
000107-21-1	Ethylene Glycol		Monsanto, Akzo Coatings
000108-10-1	Methyl Isobutyl Ketone	5000(Acute,AQTX)	Monsanto, Akzo Coatings
000108-31-6	Maleic Anhydride	5000(Acute,AQTX)	Ethyl Petroleum
000108-90-7	Chlorobenzene	1000(CTX) 100(AQTX)	Monsanto
000108 95-2	Phenol	1000(CTX,AQTX)	Excelsior Foundry Co.
000541-73-1	1,3 Dichlorobenzene	1000(CTX) 100(AQTX)	Monsanto
001310-73-2	Sodium Hydroxide	5000(Acute) 1000(AQTX)	Amax Zinc, Ethyl Petroleum, Pfizer Pigments, Monsanto, Chemtech Ind., Prairie Farms, Vertex
001330-20-7	Xylene	5000(Acute) 1000(AQTX)	Ethyl Petroleum, Monsanto, Akzo Coatings
001336-36-3	PCB's	10(PC) 1(AQTX)	Amax Zinc
001344-28-1	Aluminum Oxide		Cerro Copper, Pfizer Pigments, General Chem. Corp., Excelsior Foundry Co.
007439-92-1	Lead	5000(Acute)	Amax Zinc, Siemens Mfg. Co.
007440-39-3	Barium		Pfizer Pigments
007440-43-9	Cadmium	10(PC)	Amax Zinc
007440-47-3	Chromium	1 (and compounds)	Cerro Copper, Pfizer Pigments
007440-48-4	Cobalt	1 (and compounds)	Pfizer Pigments
007440-50-8	Copper	5000 (and compounds)	Cerro Copper
007440-66-6	Zinc	1000(CTX)	Amax Zinc, Pfizer Pigments
007647-01-0	Hydrochloric Acid	5000(Acute,AQTX)	Ethyl Petroleum, Pfizer Pigments, Monsanto, Vertex
007664-38-2	Phosphoric Acid	5000(Acute,AQTX)	Monsanto, Kaiser-Estech
007664-39-3	Hydrofluoric Acid	100(CTX) 5000(AQTX)	Chemtech Ind.
007664-41-7	Ammonia	1000(CTX) 10(AQTX)	Ethyl Petroleum, Pfizer Pigments, Monsanto, Kaiser-Estech, Chemtech Ind.
007664-93-9	Sulfuric Acid	1000(CTX,AQTX)	Cerro Copper, Amax Zinc, Ethyl Petroleum, Pfizer Pigments, Monsanto, Kaiser-Estech, General Chem. Corp., Roesch Inc.
007697-37-2	Nitric Acid	1000(CTX,AQTX)	Monsanto
007723-14-0	Phosphorous	1000(Acute) 1(AQTX)	Monsanto
007757-82-6	Sodium Sulfate		Pfizer Pigments, General Chem. Corp.
007782-50-5	Chlorine	1000(Acute) 10(AQTX)	Ethyl Petroleum, Monsanto, American Bottoms Wastewater Treatment, Vertex
007783-20-2	Ammonium Sulfate		Pfizer Pigments
N/A	Arsenic Compounds	1(PC)	Amax Zinc
N/A	Barium Compounds	10(AQTX)	Ethyl Petroleum
N/A	Cadmium Compounds	10(PC)	Amax Zinc
N/A	Copper Compounds	1000(CTX)	Amax Zinc
N/A	Lead Compounds	100(CTX,PC)	Amax Zinc
N/A	Manganese Compounds	5000(Acute) 100(AQTX)	Amax Zinc
N/A	Zinc Compounds	1000(CTX)	Amax Zinc, Ethyl Petroleum
		NOTE:	

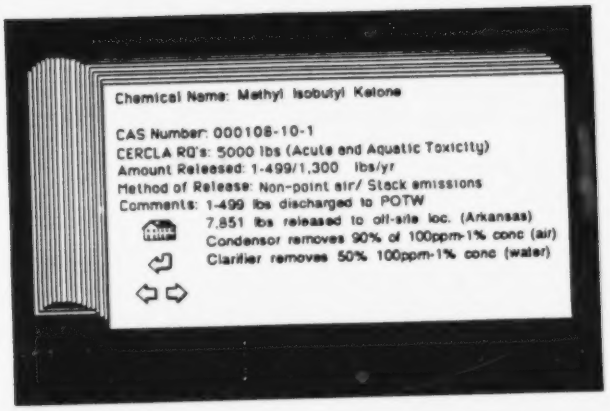
Chemicals Released in St. Clair Co., Illinois

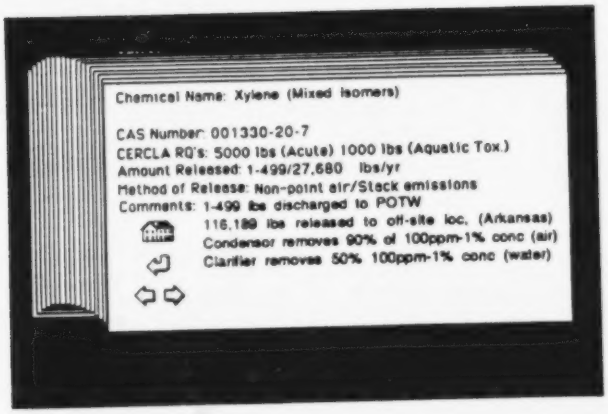
CAS Number	Chemicals	CERCLA RQ's	Companies
		AQTX = Aquatic Toxicity	
		Acute = Acute Toxicity	
		CTX = Chronic Toxicity	
		PC = Potential Carcinogenicity	

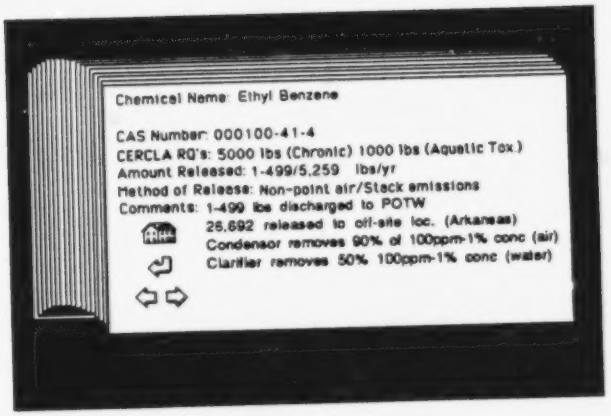

Company: Akzo Coatings
Address: 2904 Missouri Avenue
(Location) East St. Louis, Illinois 62205
Contacts: David W. Holden, (313) 589-3660 (Technical)
Elliot Lanson, (618) 271-6601 (Public)
Latitude/Longitude: N/A

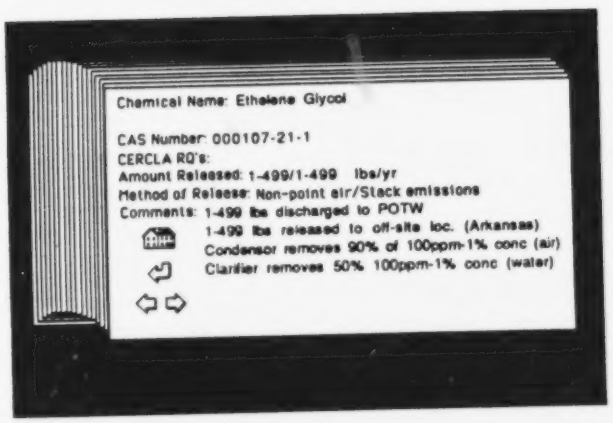

Chemical Name: Methyl methacrylate
CAS Number: 000080-62-6
CERCLA RQ's: 1000 lbs (Chronic Toxicity)
Amount Released: 1-499/1-499 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 1-499 lbs discharged to POTW
1-499 lbs released to off-site loc. (Arkansas)
Condensor removes 95% of 100ppm-1% conc. (air)
Clarification removes 50% of 100ppm-1% conc. (water)


Chemical Name: n-Butyl alcohol
CAS Number: 000071-36-3
CERCLA RQ's: 5000 lbs (Acute Toxicity)
Amount Released: 1-499/1,100 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 1-499 lbs discharged to POTW
6,281 lbs released to off-site loc. (Arkansas)
Condensor removes 95% of 100ppm-1% conc.(air)
Clarifier removes 50% of 100pp-1% conc (water)


Chemical Name: Methyl Isobutyl Kelone
CAS Number: 000108-10-1
CERCLA RQ's: 5000 lbs (Acute and Aquatic Toxicity)
Amount Released: 1-499/1,300 lbs/yr
Method of Release: Non-point air/ Stack emissions
Comments: 1-499 lbs discharged to POTW
7,851 lbs released to off-site loc. (Arkansas)
Condensor removes 90% of 100ppm-1% conc (air)
Clarifier removes 50% 100ppm-1% conc (water)


Chemical Name: Xylene (Mixed Isomers)
CAS Number: 001330-20-7
CERCLA RQ's: 5000 lbs (Acute) 1000 lbs (Aquatic Tox.)
Amount Released: 1-499/27,680 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 1-499 lbs discharged to POTW
116,189 lbs released to off-site loc. (Arkansas)
Condensor removes 90% of 100ppm-1% conc (air)
Clarifier removes 50% 100ppm-1% conc (water)


Chemical Name: Ethyl Benzene
CAS Number: 000100-41-4
CERCLA RQ's: 5000 lbs (Chronic) 1000 lbs (Aquatic Tox.)
Amount Released: 1-499/5,259 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 1-499 lbs discharged to POTW
26,692 released to off-site loc. (Arkansas)
Condensor removes 90% of 100ppm-1% conc (air)
Clarifier removes 50% 100ppm-1% conc (water)


Chemical Name: Ethelene Glycol
CAS Number: 000107-21-1
CERCLA RQ's:
Amount Released: 1-499/1-499 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 1-499 lbs discharged to POTW
1-499 lbs released to off-site loc. (Arkansas)
Condensor removes 90% of 100ppm-1% conc (air)
Clarifier removes 50% 100ppm-1% conc (water)

Company: Amax Zinc

Address: Rt. 3 and Monsanto Ave.
(Location) Sauget, Illinois 62201

Contacts: Raymond Ehrhard, (618) 274-5000

Latitude/Longitude: 38/36/30; 90/00/15

Chemical Name: Copper Compounds

CAS Number: N/A
CERCLA RQ's: 1000 lbs (Chronic Toxicity)
Amount Released: 1-499/1-499 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 1-499 lbs released to off-site loc. (Belleville,IL)
Filtration removes 99% of >1% conc.(air)

Chemical Name: Sulfuric Acid

CAS Number: 007664-93-9
CERCLA RQ's: 1000 lbs (Chronic and Aquatic Toxicity)
Amount Released: 56,000/72,200 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 500-999 lbs discharged to Sauget Village POTW
Absorbers remove 99% of >1% conc.(air)
Neutralization removes 100% of >1% conc.(water)

Chemical Name: Manganese Compounds

CAS Number: N/A
CERCLA RQ's: 5000 lbs (Chronic) 100 lbs (Aquatic)
Amount Released: 1-499 lbs/yr
Method of Release: Stack emissions
Comments: 29,100 lbs released off-site loc. (Belleville, IL);
Filtration removes 99% of >1% conc.(air)

Chemical Name: Cadmium Compounds

CAS Number: N/A
CERCLA RQ's: 10 lbs (Potential Carcinogenicity)
Amount Released: 1,200 lbs/yr
Method of Release: Stack emissions
Comments: 1-499 lbs discharged to Sauget Village POTW
4,700 lbs released to off-site loc. (Belleville,IL)
Filtration removes 99% of >100ppm conc.(air)
Chemical precipitation and clarification remove 98% of >1% conc.(water)

Chemical Name: Polychlorinated Biphenyls (PCB's)

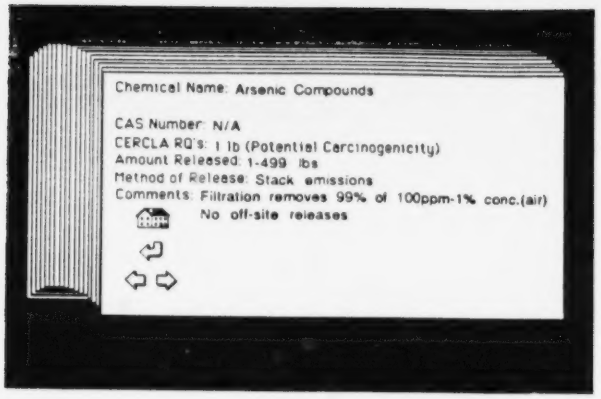
CAS Number: 001336-36-3
CERCLA RQ's: 10 lbs (Pot. Carcin.) 1lb (Aquatic Tox.)
Amount Released:
Method of Release:
Comments: 10,000-99,999 lbs kept on-site
No on-site removal, no off-site releases

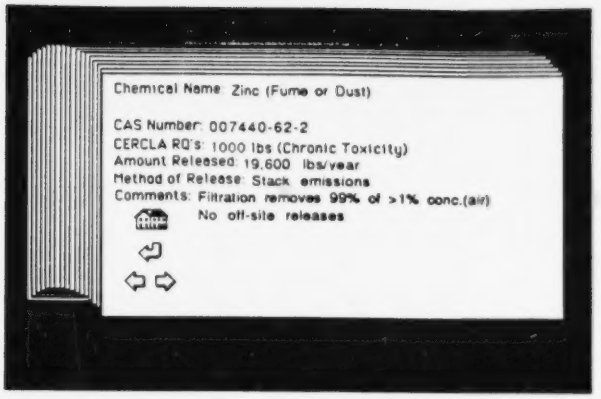
Chemical Name: Cadmium

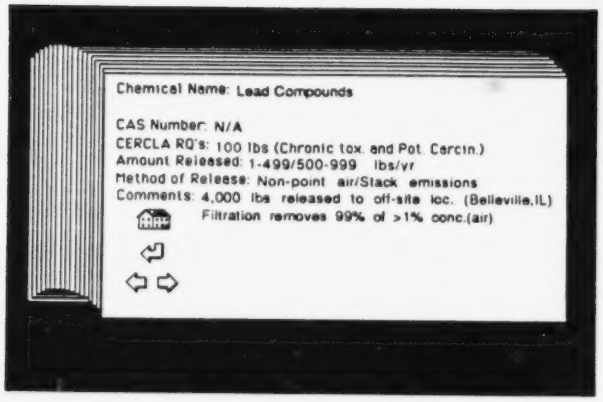
CAS Number: 007440-43-9
CERCLA RQ's: 10 lbs (Pot. Carcinogenicity)
Amount Released: 1-499 lbs/yr
Method of Release: Stack emissions
Comments: No on-site removal, no off-site releases

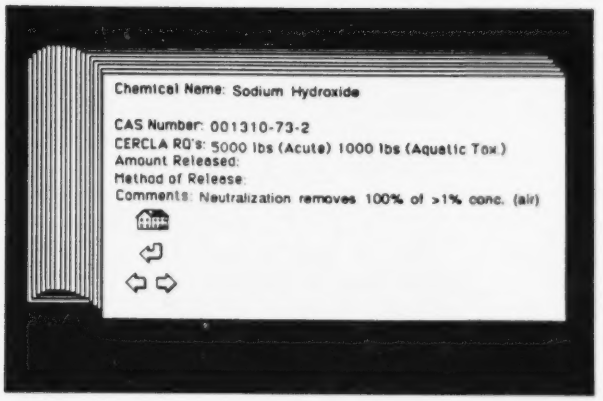
Chemical Name: Lead

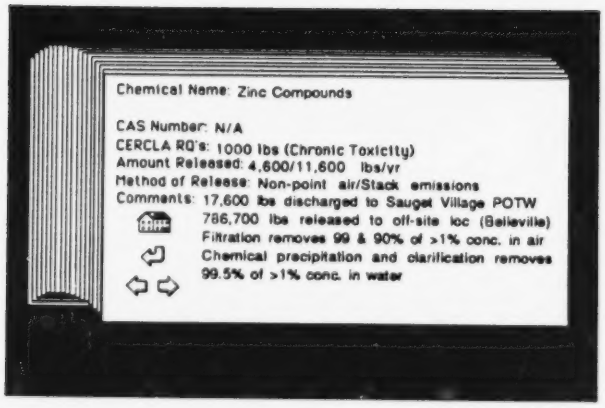
CAS Number: 007439-92-1
CERCLA RQ's: 5000 lbs (Acute Toxicity)
Amount Released:
Method of Release:
Comments: Filtration removes 99% of >1% conc.(air)
No off-site releases

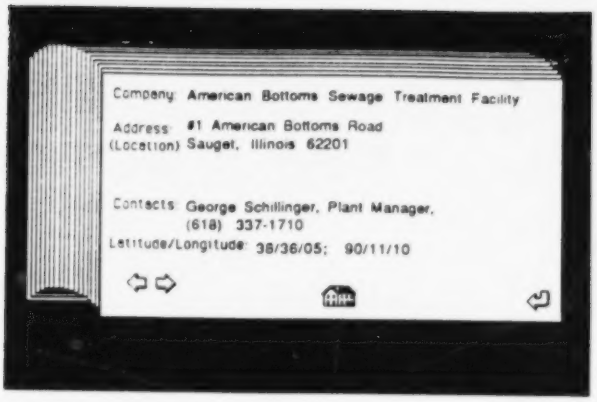

Chemical Name: Arsenic Compounds
CAS Number: N/A
CERCLA RQ's: 1 lb (Potential Carcinogenicity)
Amount Released: 1-499 lbs
Method of Release: Stack emissions
Comments: Filtration removes 99% of 100ppm-1% conc.(air)
No off-site releases

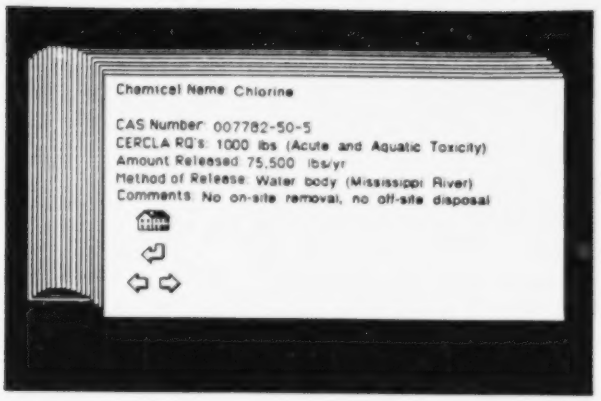

Chemical Name: Zinc (Fume or Dust)
CAS Number: 007440-62-2
CERCLA RQ's: 1000 lbs (Chronic Toxicity)
Amount Released: 19,600 lbs/year
Method of Release: Stack emissions
Comments: Filtration removes 99% of >1% conc.(air)
No off-site releases

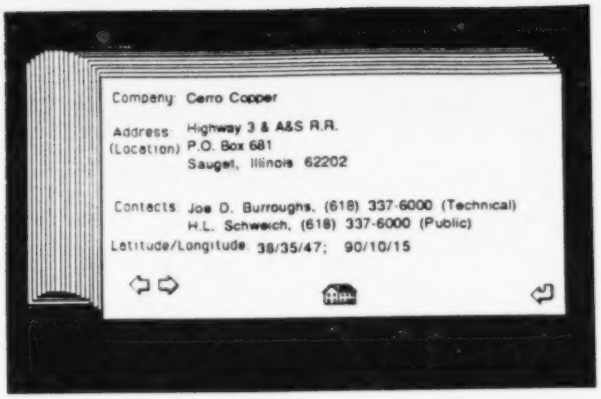

Chemical Name: Lead Compounds
CAS Number: N/A
CERCLA RQ's: 100 lbs (Chronic tox. and Pot. Carcin.)
Amount Released: 1-499/500-999 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 4,000 lbs released to off-site loc. (Belleville,IL)
Filtration removes 99% of >1% conc.(air)

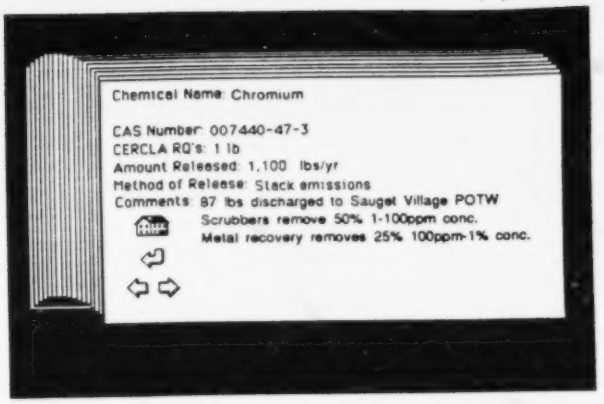

Chemical Name: Sodium Hydroxide
CAS Number: 001310-73-2
CERCLA RQ's: 5000 lbs (Acute) 1000 lbs (Aquatic Tox.)
Amount Released:
Method of Release:
Comments: Neutralization removes 100% of >1% conc. (air)

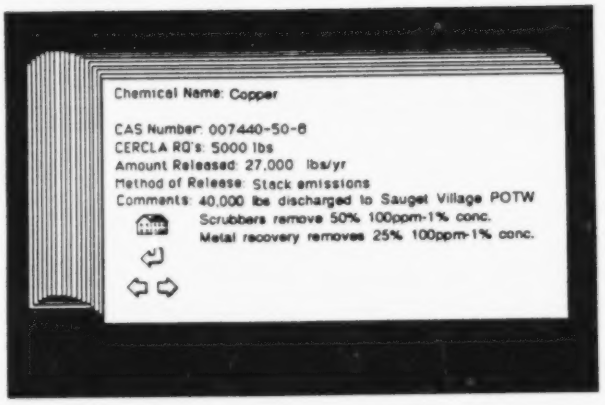

Chemical Name: Zinc Compounds
CAS Number: N/A
CERCLA RQ's: 1000 lbs (Chronic Toxicity)
Amount Released: 4,600/11,600 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 17,600 lbs discharged to Sauget Village POTW
786,700 lbs released to off-site loc (Belleville)
Filtration removes 99 & 90% of >1% conc. in air
Chemical precipitation and clarification removes 99.5% of >1% conc. in water

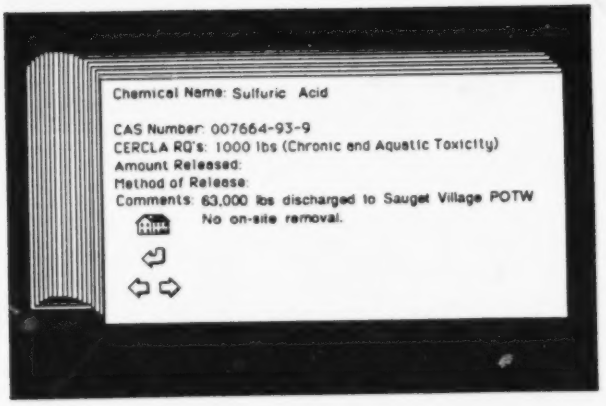

Company: American Bottoms Sewage Treatment Facility
Address: #1 American Bottoms Road
(Location) Sauget, Illinois 62201
Contacts: George Schillinger, Plant Manager,
(618) 337-1710
Latitude/Longitude: 38/36/05; 90/11/10

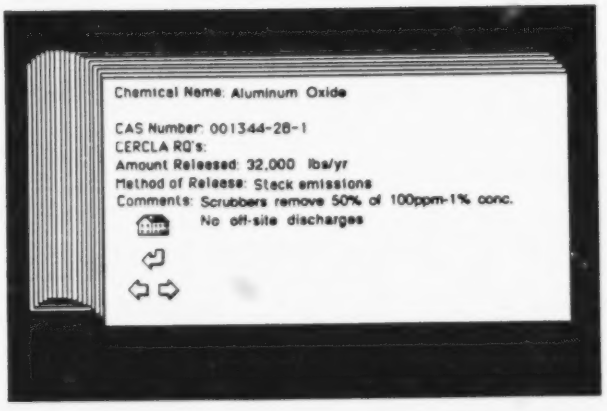

Chemical Name: Chlorine
CAS Number: 007782-50-5
CERCLA RQ's: 1000 lbs (Acute and Aquatic Toxicity)
Amount Released: 75,500 lbs/yr
Method of Release: Water body (Mississippi River)
Comments: No on-site removal, no off-site disposal

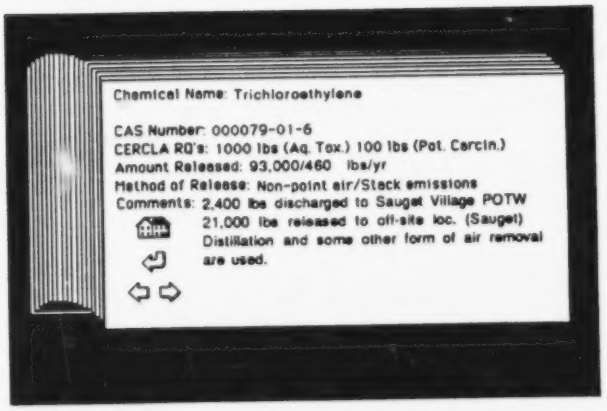

Company: Cerro Copper
Address (Location): Highway 3 & A&S R.R.
P.O. Box 681
Sauget, Illinois 62202
Contacts: Joe D. Burroughs, (618) 337-6000 (Technical)
H.L. Schweich, (618) 337-6000 (Public)
Latitude/Longitude: 38/35/47; 90/10/15

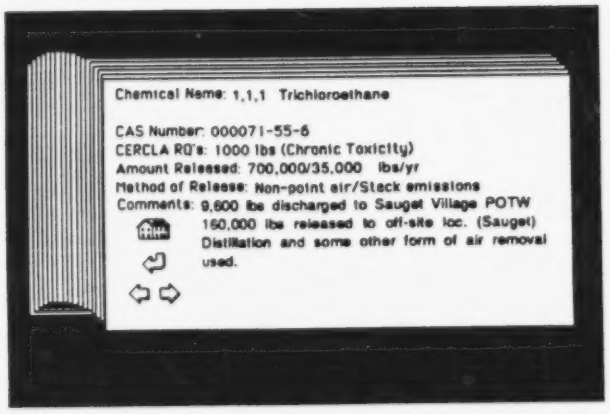

Chemical Name: Chromium
CAS Number: 007440-47-3
CERCLA RQ's: 1 lb
Amount Released: 1,100 lbs/yr
Method of Release: Stack emissions
Comments: 87 lbs discharged to Sauget Village POTW
Scrubbers remove 50% 1-100ppm conc.
Metal recovery removes 25% 100ppm-1% conc.

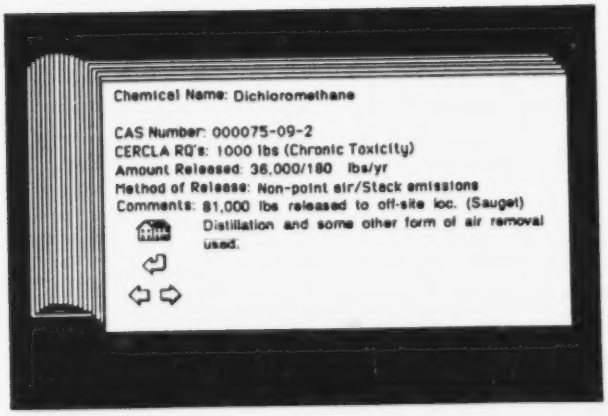

Chemical Name: Copper
CAS Number: 007440-50-8
CERCLA RQ's: 5000 lbs
Amount Released: 27,000 lbs/yr
Method of Release: Stack emissions
Comments: 40,000 lbs discharged to Sauget Village POTW
Scrubbers remove 50% 100ppm-1% conc.
Metal recovery removes 25% 100ppm-1% conc.

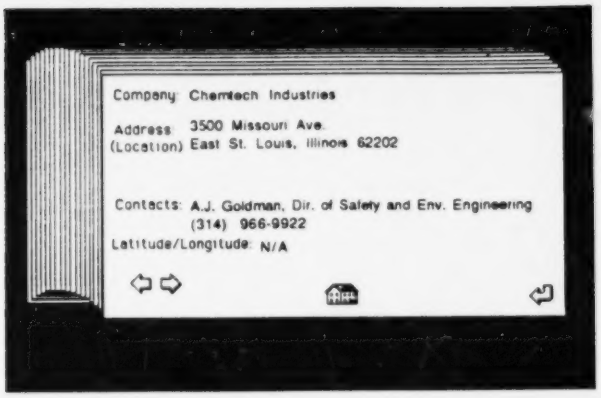

Chemical Name: Sulfuric Acid
CAS Number: 007664-93-9
CERCLA RQ's: 1000 lbs (Chronic and Aquatic Toxicity)
Amount Released:
Method of Release:
Comments: 63,000 lbs discharged to Sauget Village POTW
No on-site removal.

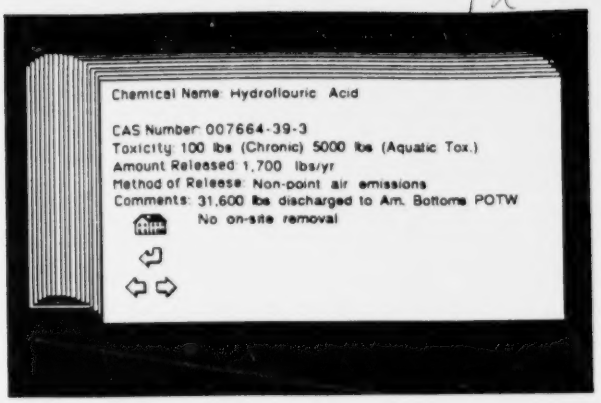

Chemical Name: Aluminum Oxide
CAS Number: 001344-28-1
CERCLA RQ's:
Amount Released: 32,000 lbs/yr
Method of Release: Stack emissions
Comments: Scrubbers remove 50% of 100ppm-1% conc.
No off-site discharges

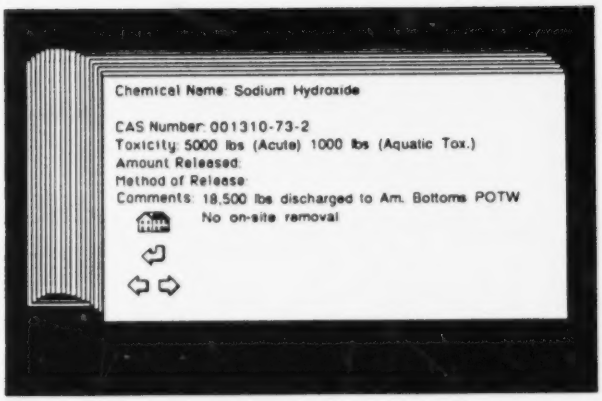

Chemical Name: Trichloroethylene
CAS Number: 000079-01-6
CERCLA RQ's: 1000 lbs (Aq. Tox.) 100 lbs (Pot. Carcin.)
Amount Released: 93,000/460 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 2,400 lbs discharged to Sauget Village POTW
21,000 lbs released to off-site loc. (Sauget)
Distillation and some other form of air removal are used.

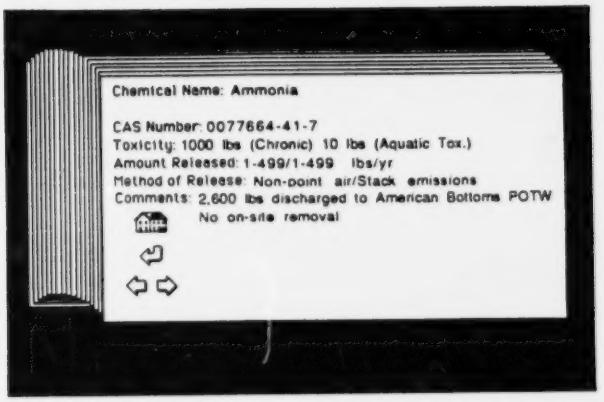

Chemical Name: 1,1,1 Trichloroethane
CAS Number: 000071-55-6
CERCLA RQ's: 1000 lbs (Chronic Toxicity)
Amount Released: 700,000/35,000 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 9,600 lbs discharged to Sauget Village POTW
160,000 lbs released to off-site loc. (Sauget)
Distillation and some other form of air removal used.

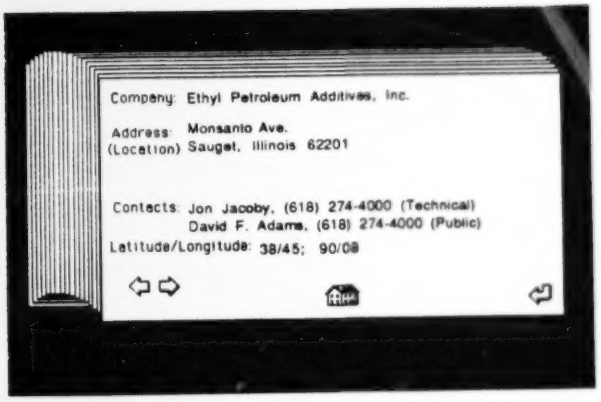

Chemical Name: Dichloromethane
CAS Number: 000075-09-2
CERCLA RQ's: 1000 lbs (Chronic Toxicity)
Amount Released: 36,000/180 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 81,000 lbs released to off-site loc. (Sauget)
Distillation and some other form of air removal used.

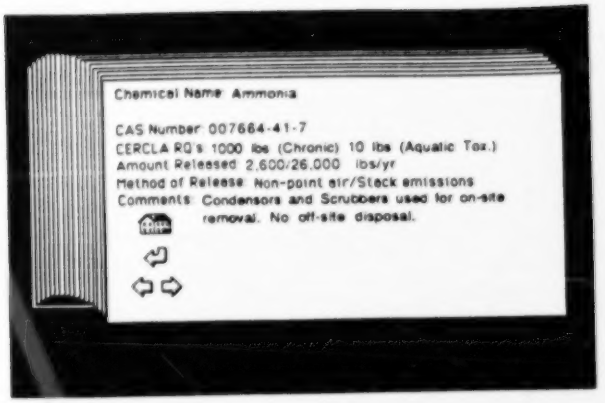

Company: Chemtech Industries
Address: 3500 Missouri Ave.
(Location) East St. Louis, Illinois 62202
Contacts: A.J. Goldman, Dir. of Safety and Env. Engineering
(314) 966-9922
Latitude/Longitude: N/A

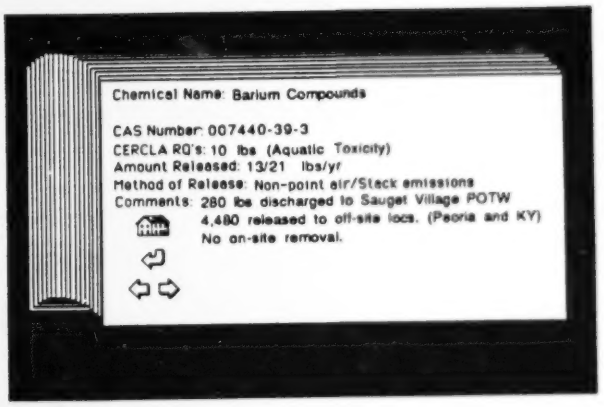

Chemical Name: Hydrofluoric Acid
CAS Number: 007664-39-3
Toxicity: 100 lbs (Chronic) 5000 lbs (Aquatic Tox.)
Amount Released: 1,700 lbs/yr
Method of Release: Non-point air emissions
Comments: 31,600 lbs discharged to Am. Bottoms POTW
No on-site removal

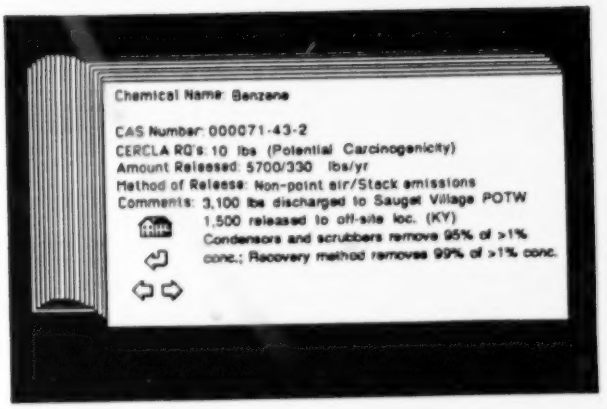

Chemical Name: Sodium Hydroxide
CAS Number: 001310-73-2
Toxicity: 5000 lbs (Acute) 1000 lbs (Aquatic Tox.)
Amount Released:
Method of Release:
Comments: 18,500 lbs discharged to Am. Bottoms POTW
No on-site removal

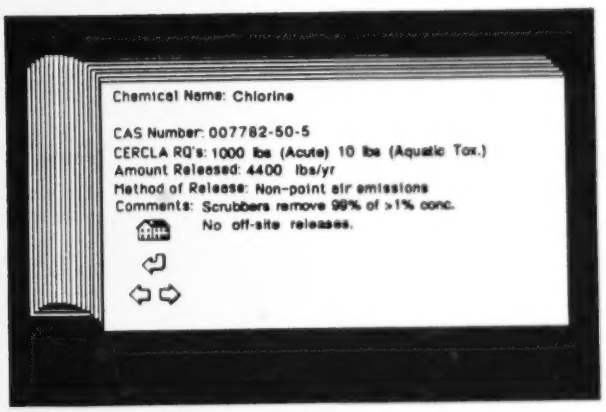

Chemical Name: Ammonia
CAS Number: 0077664-41-7
Toxicity: 1000 lbs (Chronic) 10 lbs (Aquatic Tox.)
Amount Released: 1-499/1-499 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 2,600 lbs discharged to American Bottoms POTW
No on-site removal

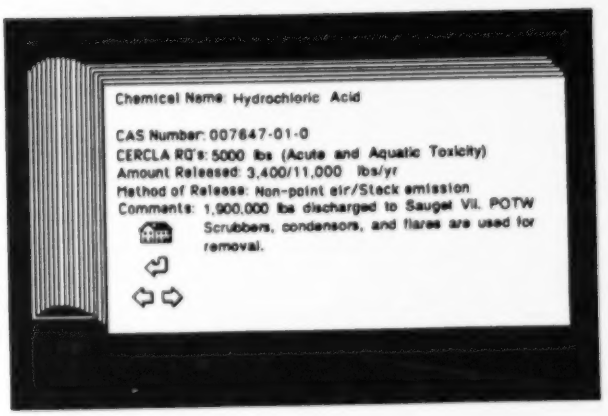

Company: Ethyl Petroleum Additives, Inc.
Address: Monsanto Ave.
(Location) Sauget, Illinois 62201
Contacts: Jon Jacoby, (618) 274-4000 (Technical)
David F. Adams, (618) 274-4000 (Public)
Latitude/Longitude: 38/45; 90/08

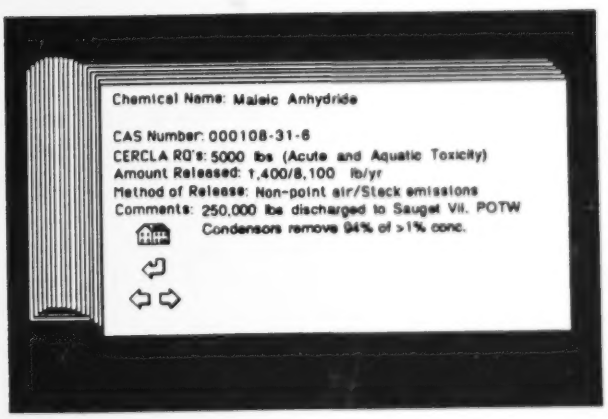

Chemical Name: Ammonia
CAS Number: 007664-41-7
CERCLA RQ's: 1000 lbs (Chronic) 10 lbs (Aquatic Tox.)
Amount Released: 2,600/26,000 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: Condensors and Scrubbers used for on-site removal. No off-site disposal.

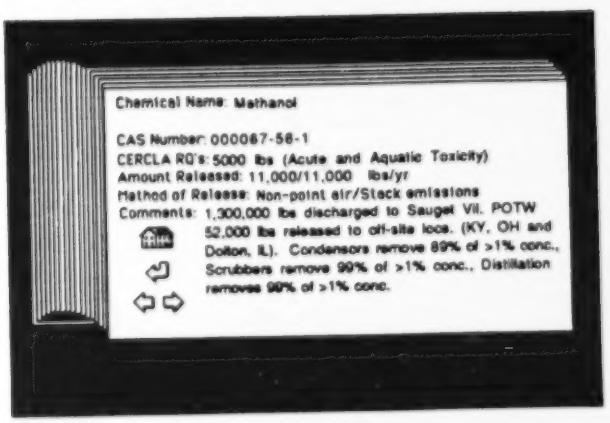

Chemical Name: Barium Compounds
CAS Number: 007440-39-3
CERCLA RQ's: 10 lbs (Aquatic Toxicity)
Amount Released: 13/21 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 280 lbs discharged to Sauget Village POTW
4,480 released to off-site locs. (Peoria and KY)
No on-site removal.

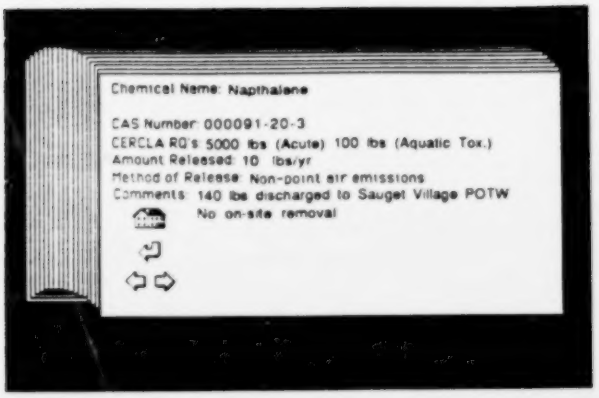

Chemical Name: Benzene
CAS Number: 000071-43-2
CERCLA RQ's: 10 lbs (Potential Carcinogenicity)
Amount Released: 5700/330 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 3,100 lbs discharged to Sauget Village POTW
1,500 released to off-site loc. (KY)
Condensors and scrubbers remove 95% of >1% conc.; Recovery method removes 99% of >1% conc.

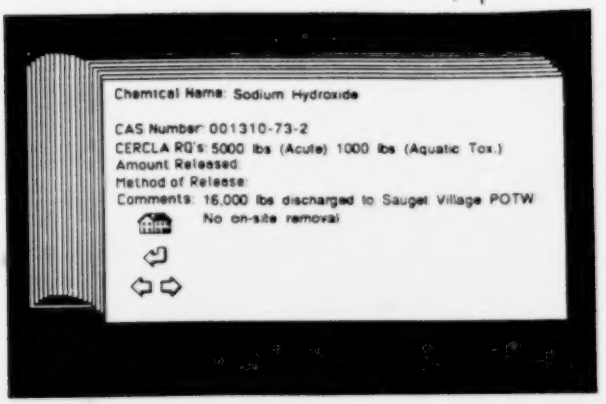

Chemical Name: Chlorine
CAS Number: 007782-50-5
CERCLA RQ's: 1000 lbs (Acute) 10 lbs (Aquatic Tox.)
Amount Released: 4400 lbs/yr
Method of Release: Non-point air emissions
Comments: Scrubbers remove 98% of >1% conc.
No off-site releases.

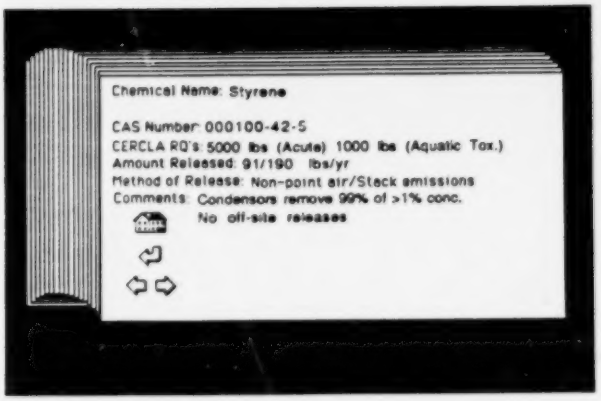

Chemical Name: Hydrochloric Acid
CAS Number: 007647-01-0
CERCLA RQ's: 5000 lbs (Acute and Aquatic Toxicity)
Amount Released: 3,400/11,000 lbs/yr
Method of Release: Non-point air/Stack emission
Comments: 1,900,000 lbs discharged to Sauget Vil. POTW
Scrubbers, condensors, and flares are used for removal.

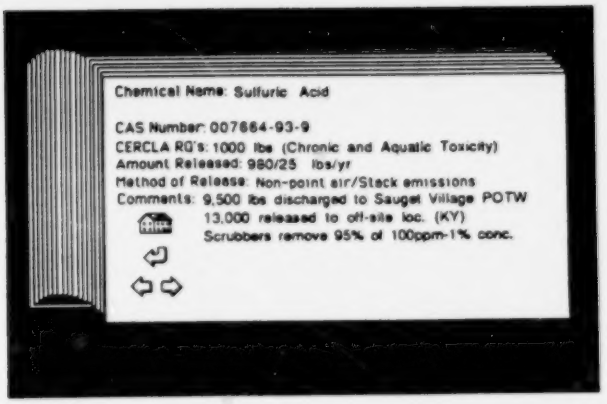

Chemical Name: Maleic Anhydride
CAS Number: 000108-31-6
CERCLA RQ's: 5000 lbs (Acute and Aquatic Toxicity)
Amount Released: 1,400/8,100 lb/yr
Method of Release: Non-point air/Stack emissions
Comments: 250,000 lbs discharged to Sauget Vil. POTW
Condensors remove 94% of >1% conc.

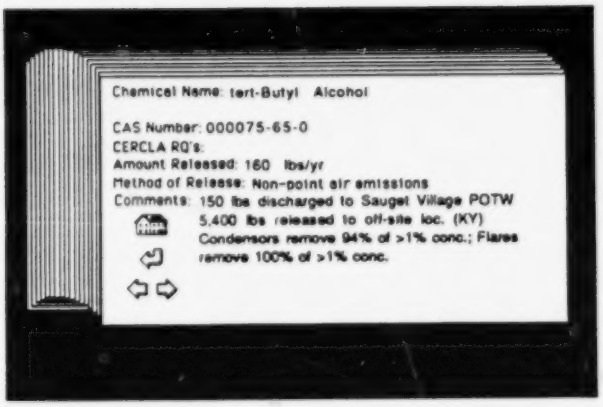

Chemical Name: Methanol
CAS Number: 000067-56-1
CERCLA RQ's: 5000 lbs (Acute and Aquatic Toxicity)
Amount Released: 11,000/11,000 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 1,300,000 lbs discharged to Sauget Vil. POTW
52,000 lbs released to off-site locs. (KY, OH and Dolton, IL). Condensors remove 89% of >1% conc., Scrubbers remove 99% of >1% conc., Distillation removes 99% of >1% conc.

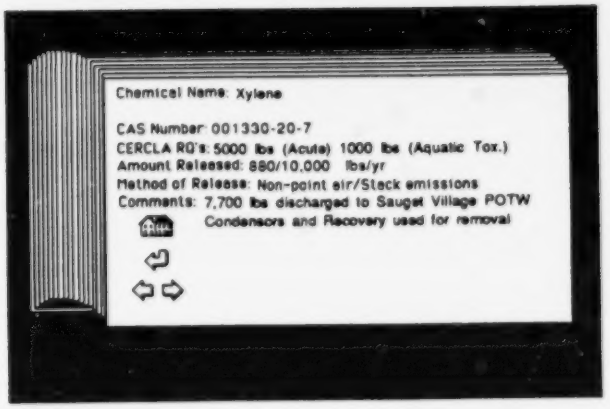

Chemical Name: Napthalene
CAS Number: 000091-20-3
CERCLA RQ's: 5000 lbs (Acute) 100 lbs (Aquatic Tox.)
Amount Released: 10 lbs/yr
Method of Release: Non-point air emissions
Comments: 140 lbs discharged to Sauget Village POTW
No on-site removal

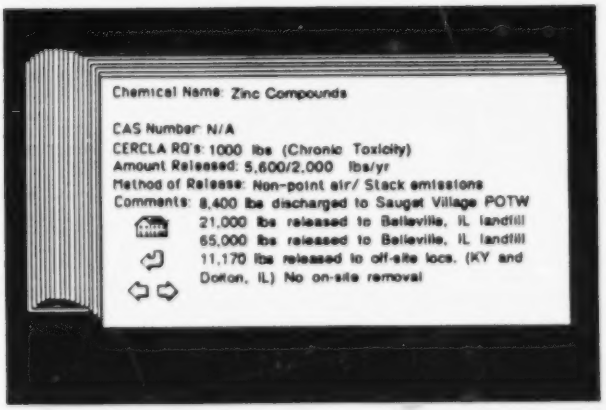

Chemical Name: Sodium Hydroxide
CAS Number: 001310-73-2
CERCLA RQ's: 5000 lbs (Acute) 1000 lbs (Aquatic Tox.)
Amount Released:
Method of Release:
Comments: 16,000 lbs discharged to Sauget Village POTW
No on-site removal

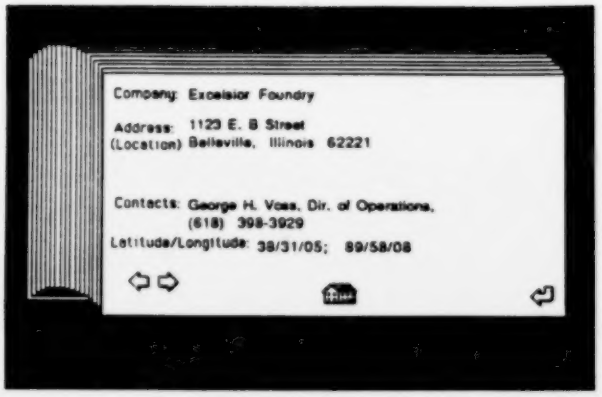

Chemical Name: Styrene
CAS Number: 000100-42-5
CERCLA RQ's: 5000 lbs (Acute) 1000 lbs (Aquatic Tox.)
Amount Released: 91/190 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: Condensors remove 99% of >1% conc.
No off-site releases

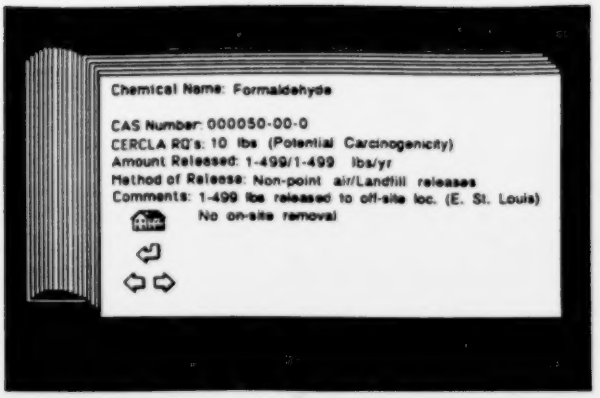

Chemical Name: Sulfuric Acid
CAS Number: 007664-93-9
CERCLA RQ's: 1000 lbs (Chronic and Aquatic Toxicity)
Amount Released: 980/25 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 9,500 lbs discharged to Sauget Village POTW
13,000 released to off-site loc. (KY)
Scrubbers remove 95% of 100ppm-1% conc.

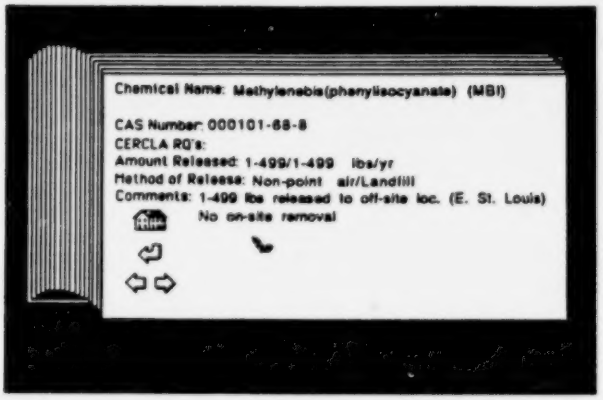

Chemical Name: tert-Butyl Alcohol
CAS Number: 000075-65-0
CERCLA RQ's:
Amount Released: 160 lbs/yr
Method of Release: Non-point air emissions
Comments: 150 lbs discharged to Sauget Village POTW
5,400 lbs released to off-site loc. (KY)
Condensors remove 94% of >1% conc.; Flares remove 100% of >1% conc.

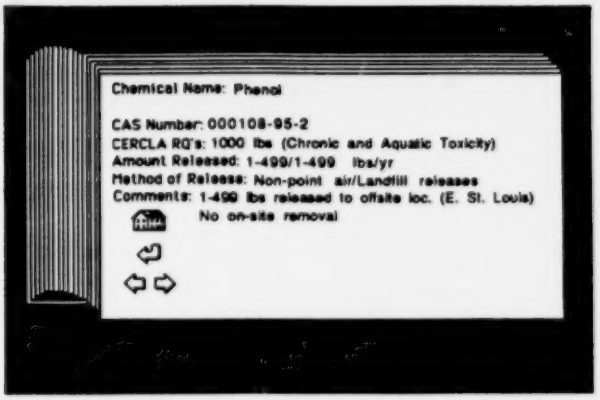

Chemical Name: Xylene
CAS Number: 001330-20-7
CERCLA RQ's: 5000 lbs (Acute) 1000 lbs (Aquatic Tox.)
Amount Released: 880/10,000 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 7,700 lbs discharged to Sauget Village POTW
Condensors and Recovery used for removal

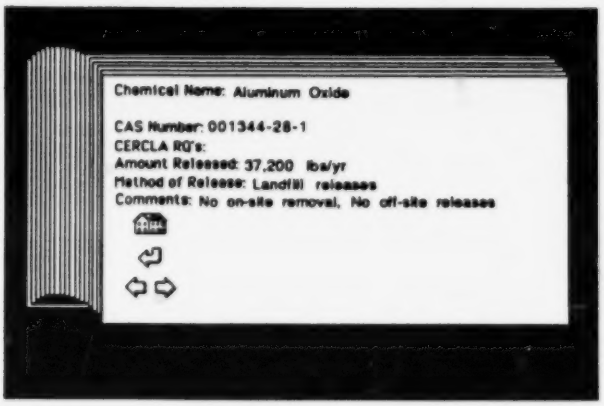

Chemical Name: Zinc Compounds
CAS Number: N/A
CERCLA RQ's: 1000 lbs (Chronic Toxicity)
Amount Released: 5,600/2,000 lbs/yr
Method of Release: Non-point air/ Stack emissions
Comments: 8,400 lbs discharged to Sauget Village POTW
21,000 lbs released to Belleville, IL landfill
65,000 lbs released to Belleville, IL landfill
11,170 lbs released to off-site locs. (KY and Dorton, IL) No on-site removal

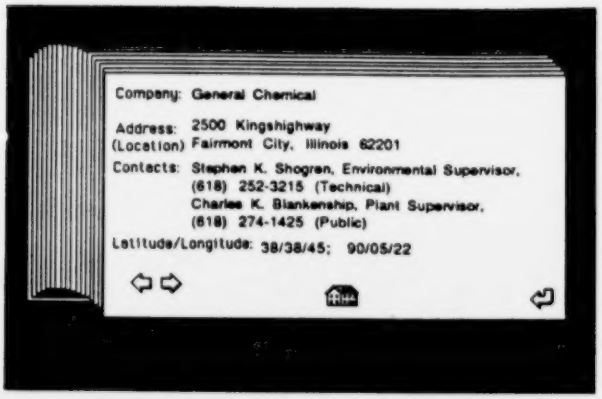

Company: Excelsior Foundry
Address: 1123 E. B Street
(Location) Belleville, Illinois 62221
Contacts: George H. Voss, Dir. of Operations,
(618) 398-3929
Latitude/Longitude: 38/31/05; 89/58/08

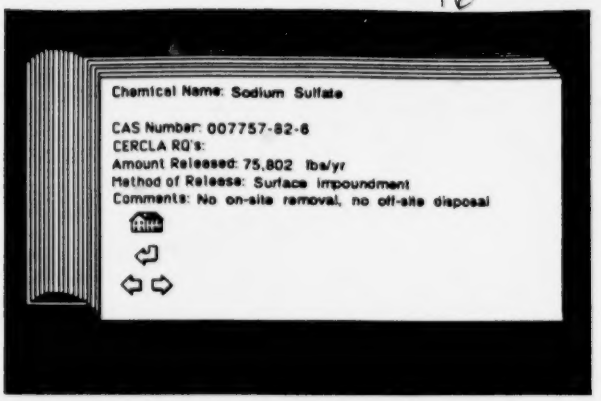

Chemical Name: Formaldehyde
CAS Number: 000050-00-0
CERCLA RQ's: 10 lbs (Potential Carcinogenicity)
Amount Released: 1-499/1-499 lbs/yr
Method of Release: Non-point air/Landfill releases
Comments: 1-499 lbs released to off-site loc. (E. St. Louis)
No on-site removal

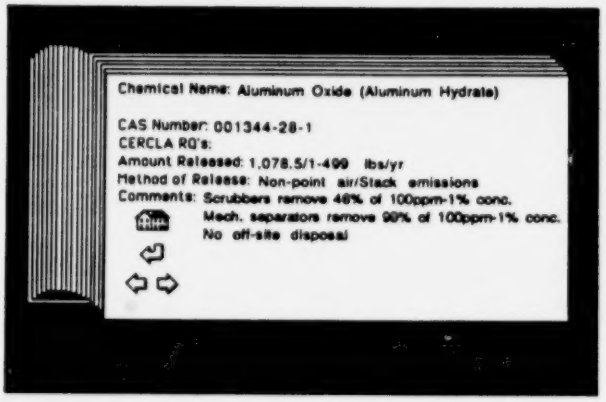

Chemical Name: Methylenebis(phenylisocyanate) (MBI)
CAS Number: 000101-68-8
CERCLA RQ's:
Amount Released: 1-499/1-499 lbs/yr
Method of Release: Non-point air/Landfill
Comments: 1-499 lbs released to off-site loc. (E. St. Louis)
No on-site removal

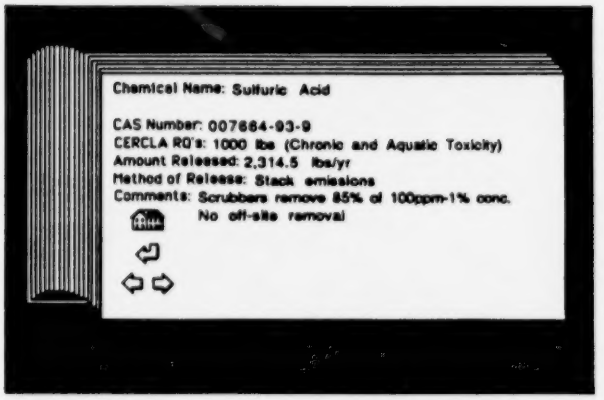

Chemical Name: Phenol
CAS Number: 000108-95-2
CERCLA RQ's: 1000 lbs (Chronic and Aquatic Toxicity)
Amount Released: 1-499/1-499 lbs/yr
Method of Release: Non-point air/Landfill releases
Comments: 1-499 lbs released to offsite loc. (E. St. Louis)
No on-site removal


Chemical Name: Aluminum Oxide
CAS Number: 001344-28-1
CERCLA RQ's:
Amount Released: 37,200 lbs/yr
Method of Release: Landfill releases
Comments: No on-site removal, No off-site releases

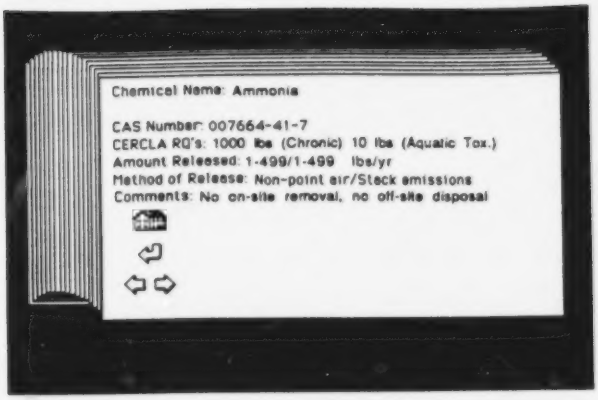

Company: General Chemical
Address: 2500 Kingshighway
(Location) Fairmont City, Illinois 62201
Contacts: Stephen K. Shogren, Environmental Supervisor,
(618) 252-3215 (Technical)
Charles K. Blankenship, Plant Supervisor,
(618) 274-1425 (Public)
Latitude/Longitude: 38/38/45; 90/05/22

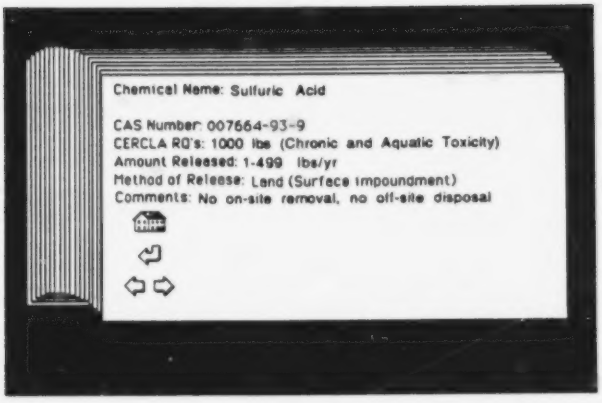

Chemical Name: Sodium Sulfate
CAS Number: 007757-82-6
CERCLA RQ's:
Amount Released: 75,802 lbs/yr
Method of Release: Surface Impoundment
Comments: No on-site removal, no off-site disposal

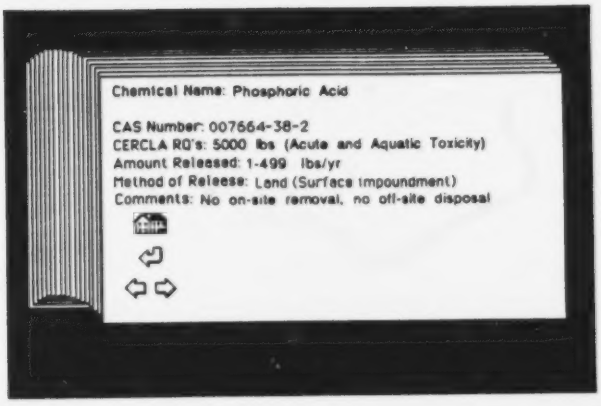

Chemical Name: Aluminum Oxide (Aluminum Hydrate)
CAS Number: 001344-28-1
CERCLA RQ's:
Amount Released: 1,078.5/1-499 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: Scrubbers remove 46% of 100ppm-1% conc.
Mech. separators remove 90% of 100ppm-1% conc.
No off-site disposal

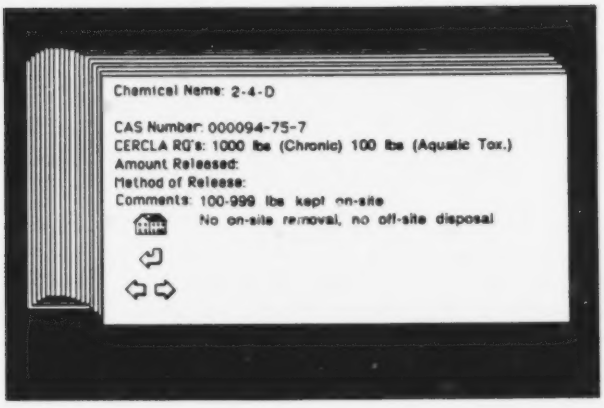

Chemical Name: Sulfuric Acid
CAS Number: 007664-93-9
CERCLA RQ's: 1000 lbs (Chronic and Aquatic Toxicity)
Amount Released: 2,314.5 lbs/yr
Method of Release: Stack emissions
Comments: Scrubbers remove 85% of 100ppm-1% conc.
No off-site removal

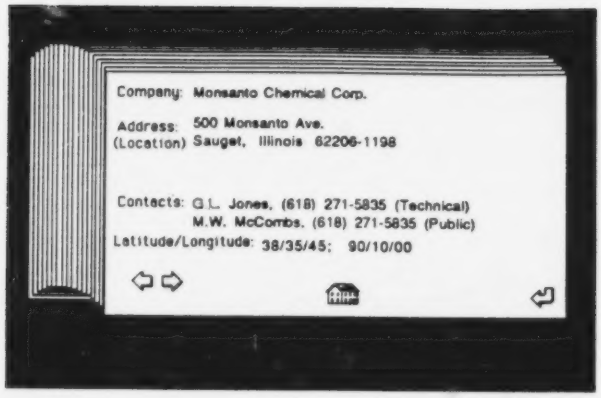
Company: Kaiser-Estech
Address: 2501 Kingshighway
(Location) East St. Louis, Illinois 62202
Contacts: Spencer E. Hall, (912) 235-3717
Latitude/Longitude: 38/38/40; 90/05/40

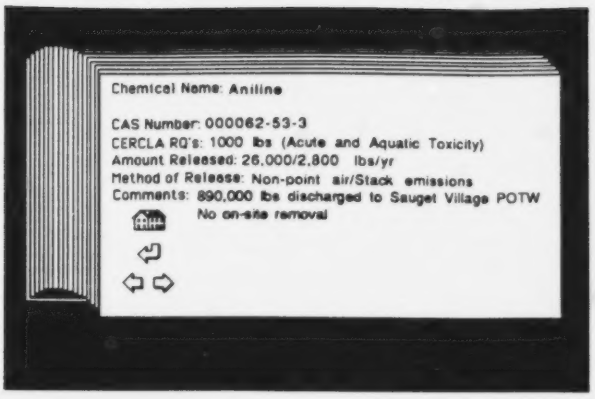

Chemical Name: Ammonia
CAS Number: 007664-41-7
CERCLA RQ's: 1000 lbs (Chronic) 10 lbs (Aquatic Tox.)
Amount Released: 1-499/1-499 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: No on-site removal, no off-site disposal

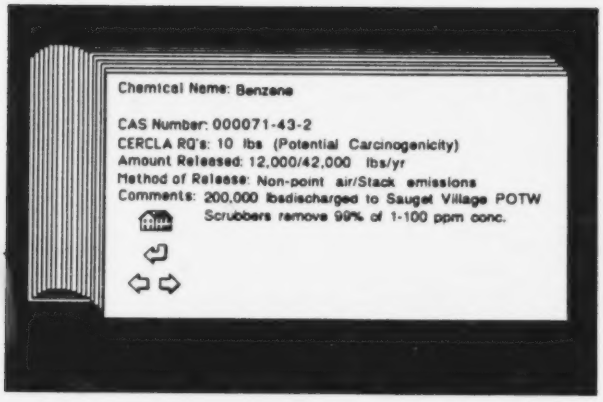

Chemical Name: Sulfuric Acid
CAS Number: 007664-93-9
CERCLA RQ's: 1000 lbs (Chronic and Aquatic Toxicity)
Amount Released: 1-499 lbs/yr
Method of Release: Land (Surface Impoundment)
Comments: No on-site removal, no off-site disposal

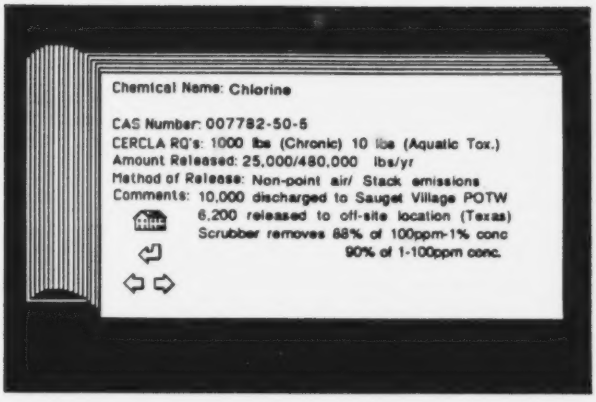

Chemical Name: Phosphoric Acid
CAS Number: 007664-38-2
CERCLA RQ's: 5000 lbs (Acute and Aquatic Toxicity)
Amount Released: 1-499 lbs/yr
Method of Release: Land (Surface Impoundment)
Comments: No on-site removal, no off-site disposal

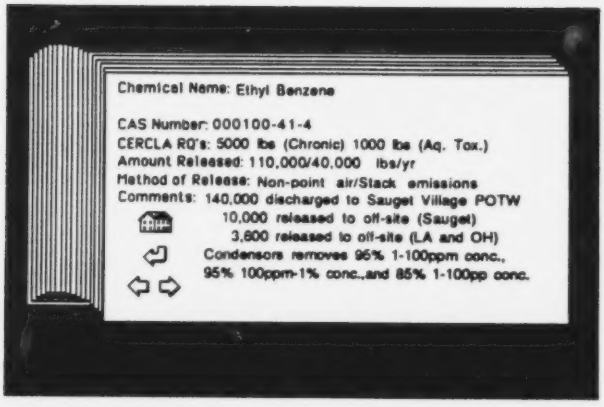

Chemical Name: 2-4-D
CAS Number: 000094-75-7
CERCLA RQ's: 1000 lbs (Chronic) 100 lbs (Aquatic Tox.)
Amount Released:
Method of Release:
Comments: 100-999 lbs kept on-site
No on-site removal, no off-site disposal

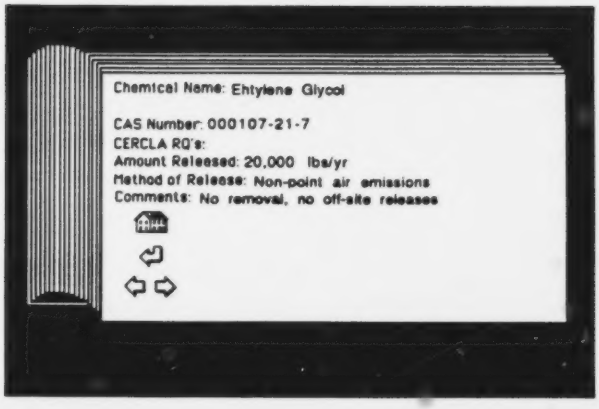

Company: Monsanto Chemical Corp.
Address: 500 Monsanto Ave.
(Location) Sauget, Illinois 62206-1198
Contacts: G.L. Jones, (618) 271-5835 (Technical)
M.W. McCombs, (618) 271-5835 (Public)
Latitude/Longitude: 38/35/45; 90/10/00

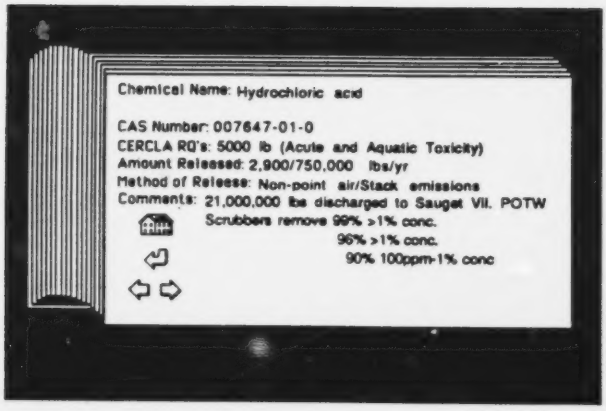

Chemical Name: Aniline
CAS Number: 000062-53-3
CERCLA RQ's: 1000 lbs (Acute and Aquatic Toxicity)
Amount Released: 26,000/2,800 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 890,000 lbs discharged to Sauget Village POTW
No on-site removal

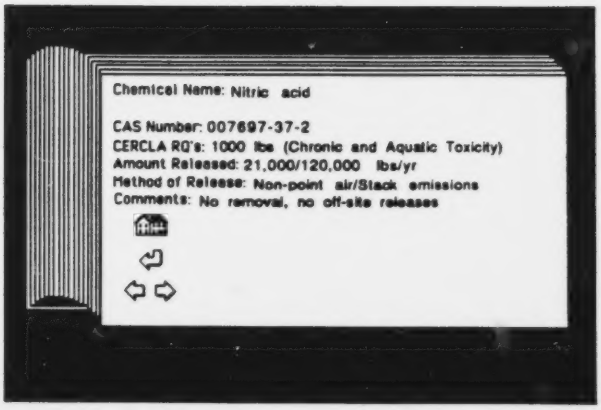

Chemical Name: Benzene
CAS Number: 000071-43-2
CERCLA RQ's: 10 lbs (Potential Carcinogenicity)
Amount Released: 12,000/42,000 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 200,000 lbsdischarged to Sauget Village POTW
Scrubbers remove 99% of 1-100 ppm conc.

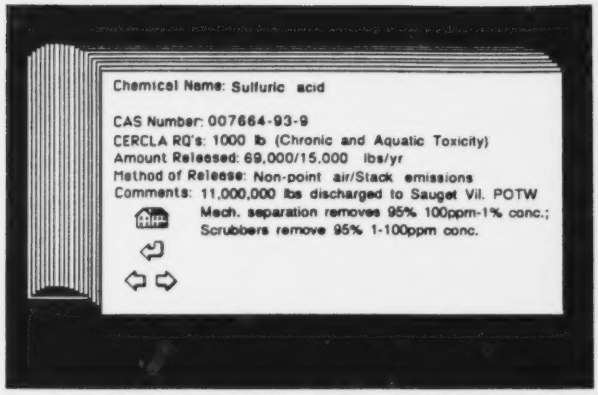

Chemical Name: Chlorine
CAS Number: 007782-50-5
CERCLA RQ's: 1000 lbs (Chronic) 10 lbs (Aquatic Tox.)
Amount Released: 25,000/480,000 lbs/yr
Method of Release: Non-point air/ Stack emissions
Comments: 10,000 discharged to Sauget Village POTW
6,200 released to off-site location (Texas)
Scrubber removes 88% of 100ppm-1% conc
90% of 1-100ppm conc.

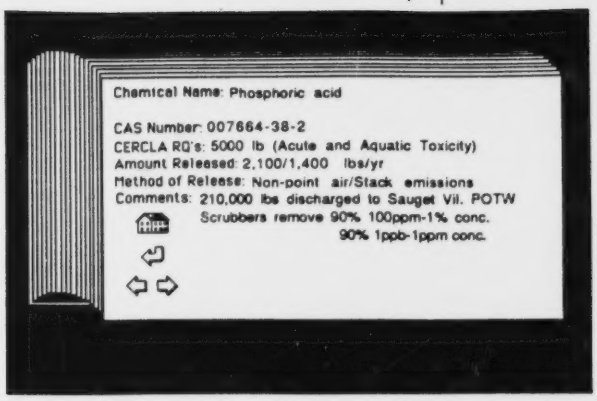

Chemical Name: Ethyl Benzene
CAS Number: 000100-41-4
CERCLA RQ's: 5000 lbs (Chronic) 1000 lbs (Aq. Tox.)
Amount Released: 110,000/40,000 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 140,000 discharged to Sauget Village POTW
10,000 released to off-site (Sauget)
3,600 released to off-site (LA and OH)
Condensors removes 95% 1-100ppm conc.,
95% 100ppm-1% conc.,and 85% 1-100pp conc.

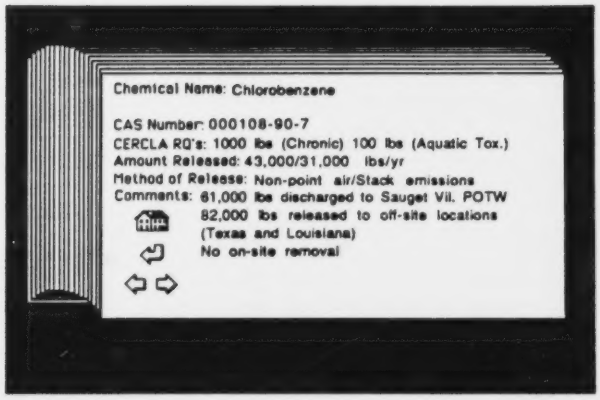

Chemical Name: Ehtylene Glycol
CAS Number: 000107-21-7
CERCLA RQ's:
Amount Released: 20,000 lbs/yr
Method of Release: Non-point air emissions
Comments: No removal, no off-site releases

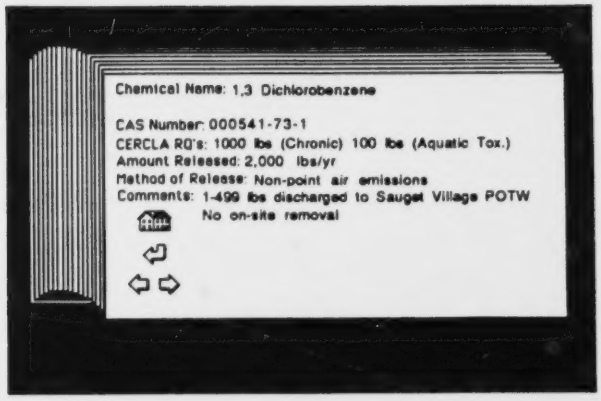

Chemical Name: Hydrochloric acid
CAS Number: 007647-01-0
CERCLA RQ's: 5000 lb (Acute and Aquatic Toxicity)
Amount Released: 2,900/750,000 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 21,000,000 lbs discharged to Sauget Vil. POTW
Scrubbers remove 99% >1% conc.
96% >1% conc.
90% 100ppm-1% conc

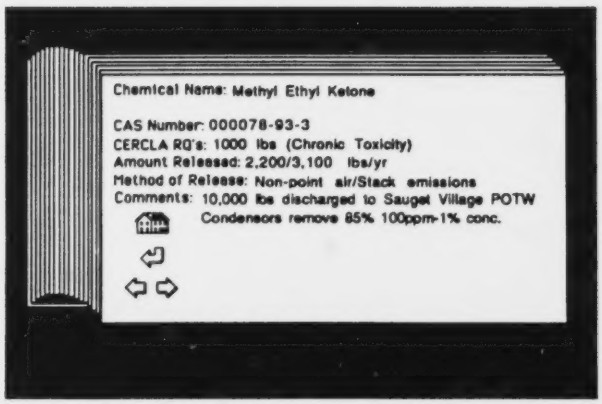

Chemical Name: Nitric acid
CAS Number: 007697-37-2
CERCLA RQ's: 1000 lbs (Chronic and Aquatic Toxicity)
Amount Released: 21,000/120,000 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: No removal, no off-site releases

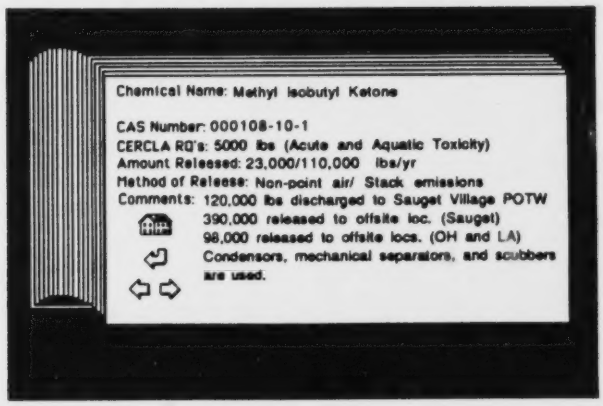

Chemical Name: Sulfuric acid
CAS Number: 007664-93-9
CERCLA RQ's: 1000 lb (Chronic and Aquatic Toxicity)
Amount Released: 69,000/15,000 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 11,000,000 lbs discharged to Sauget Vil. POTW
Mech. separation removes 95% 100ppm-1% conc.;
Scrubbers remove 95% 1-100ppm conc.

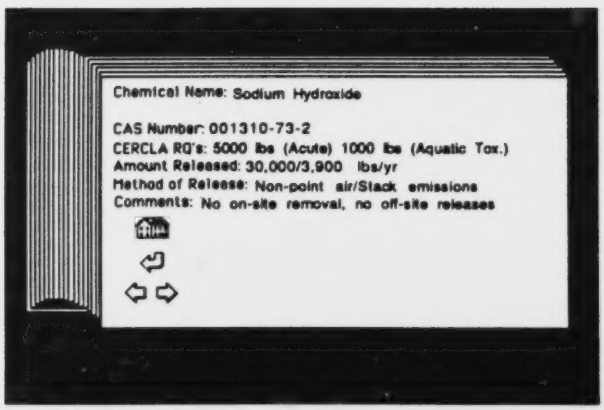

Chemical Name: Phosphoric acid
CAS Number: 007664-38-2
CERCLA RQ's: 5000 lb (Acute and Aquatic Toxicity)
Amount Released: 2,100/1,400 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 210,000 lbs discharged to Sauget Vil. POTW
Scrubbers remove 90% 100ppm-1% conc.
90% 1ppb-1ppm conc.

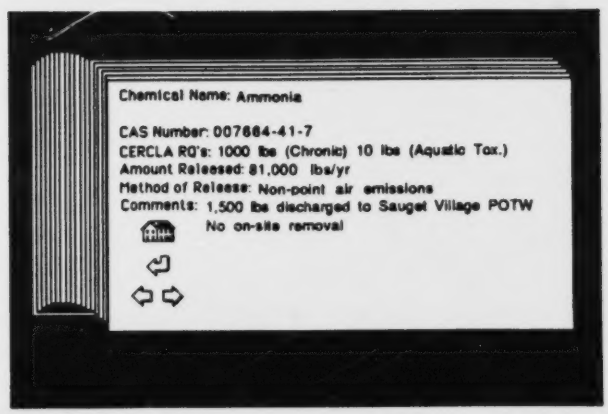

Chemical Name: Chlorobenzene
CAS Number: 000108-90-7
CERCLA RQ's: 1000 lbs (Chronic) 100 lbs (Aquatic Tox.)
Amount Released: 43,000/31,000 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 61,000 lbs discharged to Sauget Vil. POTW
82,000 lbs released to off-site locations
(Texas and Louisiana)
No on-site removal


Chemical Name: 1,3 Dichlorobenzene
CAS Number: 000541-73-1
CERCLA RQ's: 1000 lbs (Chronic) 100 lbs (Aquatic Tox.)
Amount Released: 2,000 lbs/yr
Method of Release: Non-point air emissions
Comments: 1-499 lbs discharged to Sauget Village POTW
No on-site removal


Chemical Name: Methyl Ethyl Ketone
CAS Number: 000078-93-3
CERCLA RQ's: 1000 lbs (Chronic Toxicity)
Amount Released: 2,200/3,100 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 10,000 lbs discharged to Sauget Village POTW
Condensors remove 85% 100ppm-1% conc.


Chemical Name: Methyl Isobutyl Ketone
CAS Number: 000108-10-1
CERCLA RQ's: 5000 lbs (Acute and Aquatic Toxicity)
Amount Released: 23,000/110,000 lbs/yr
Method of Release: Non-point air/ Stack emissions
Comments: 120,000 lbs discharged to Sauget Village POTW
390,000 released to offsite loc. (Sauget)
98,000 released to offsite locs. (OH and LA)
Condensors, mechanical separators, and scubbers
are used.


Chemical Name: Sodium Hydroxide
CAS Number: 001310-73-2
CERCLA RQ's: 5000 lbs (Acute) 1000 lbs (Aquatic Tox.)
Amount Released: 30,000/3,900 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: No on-site removal, no off-site releases


Chemical Name: Ammonia
CAS Number: 007664-41-7
CERCLA RQ's: 1000 lbs (Chronic) 10 lbs (Aquatic Tox.)
Amount Released: 81,000 lbs/yr
Method of Release: Non-point air emissions
Comments: 1,500 lbs discharged to Sauget Village POTW
No on-site removal

Chemical Name: 1,2 Dichlorobenzene

CAS Number: 000095-50-1
CERCLA RQ's: 1000 lbs (Chronic) 100 lbs (Aquatic Tox.)
Amount Released: 80,000/210,000 lbs/yr
Method of Release: Non-point/Stack emissions
Comments: 6,000 lbs. discharged to Sauget Village POTW
500-999 released to off-site loc. (Sauget)
5,700 released to off-site locs. (IL,LA and TX)
Condensors remove 95% 1-100ppm conc.

Chemical Name: 2 Nitrophenol

CAS Number: 000088-75-5
CERCLA RQ's: 5000 lbs (Acute) 100 lbs (Aquatic Tox.)
Amount Released: 26,000/1,000 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 120,000 lbs discharged to Sauget Village POTW
4,000 released to off-site loc. (Louisiana)
No on-site removal

Chemical Name: 1,4 Dichlorobenzene

CAS Number: 000106-46-7
CERCLA RQ's: 1000 lbs (Chronic) 100 lbs (Aquatic Tox.)
Amount Released: 210,000/540,000 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 80,000 lbs discharged to Sauget Village POTW
4,000 released to off-site loc. (Sauget)
75,000 released to off-site locs. (IL,LA and TX)
Condensors remove 95% 1-100ppm conc.

Chemical Name: 4-Nitrophenol

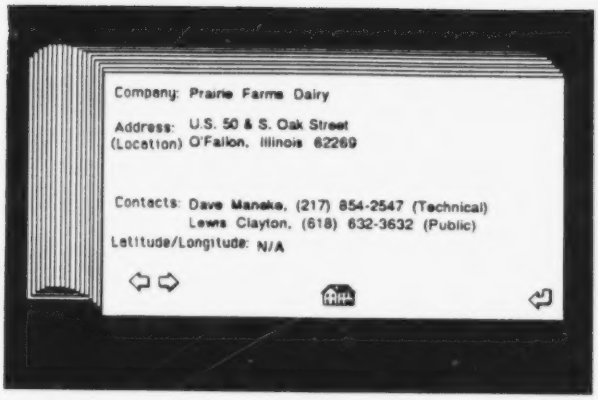
CAS Number: 000100-02-7
CERCLA RQ's: 5000 lbs (Acute) 100 lbs (Aquatic Tox.)
Amount Released: 2,200 lbs/yr
Method of Release: Non-point air emissions
Comments: 92,000 lbs discharged to Sauget Village POTW
1,000 released to off-site loc. (Sauget)
174,000 released to off-site locs. (IL, LA and AR)
No on-site removal

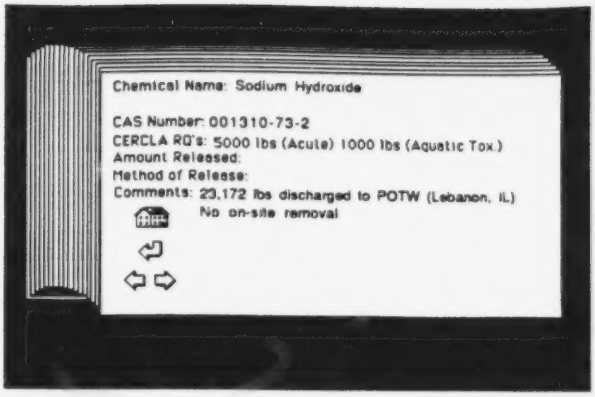
Chemical Name: Phosphorous (Yellow or White)

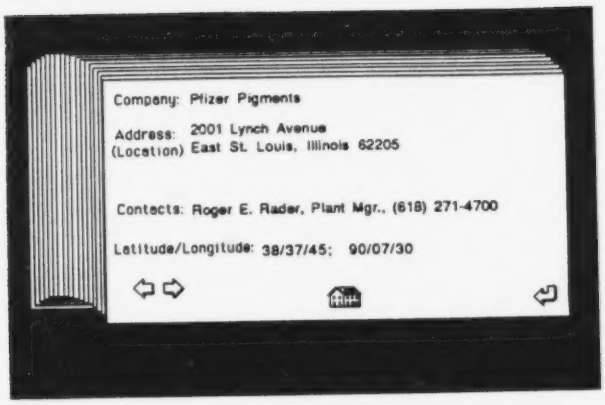
CAS Number: 007723-14-0
CERCLA RQ's: 1000 lbs (Acute) 1 lbs (Aquatic Tox.)
Amount Released: 500-999/1-499 lbs/yr
Method of Release: Non-point air/ Stack emissions
Comments: 1-499 lbs discharged to Sauget Village POTW
No on-site removal

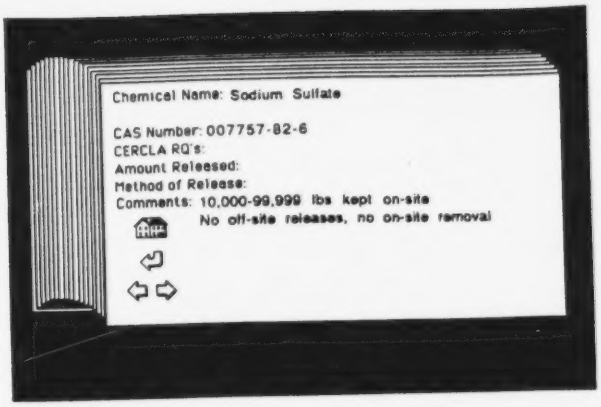
Chemical Name: Xylene (Mixed Isomers)

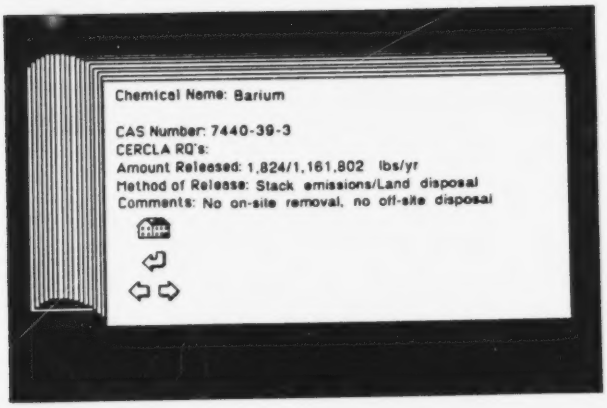
CAS Number: 001330-20-7
CERCLA RQ's: 5000 lbs (Acute) 1000 lbs (Aquatic Tox.)
Amount Released: 470,000/240,000 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: 610,000 lbs discharged to Sauget Village POTW
50,000 lbs released to off-site loc. (Sauget)
17,800 lbs released to off-site locs. (OH and LA)
Condensors and mechanical separation used for removal in waste stream.

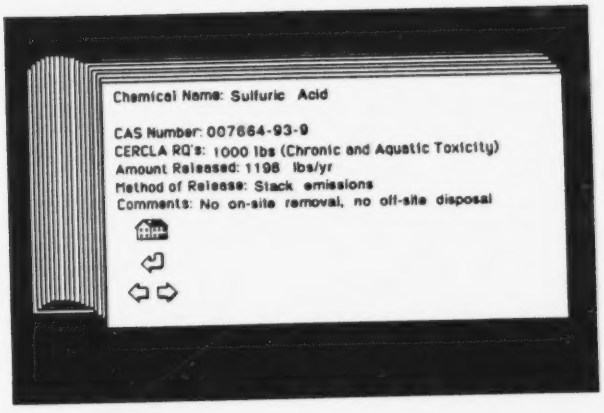

Company: Prairie Farms Dairy
Address: U.S. 50 & S. Oak Street
(Location) O'Fallon, Illinois 62269
Contacts: Dave Maneke, (217) 854-2547 (Technical)
Lewis Clayton, (618) 632-3632 (Public)
Latitude/Longitude: N/A

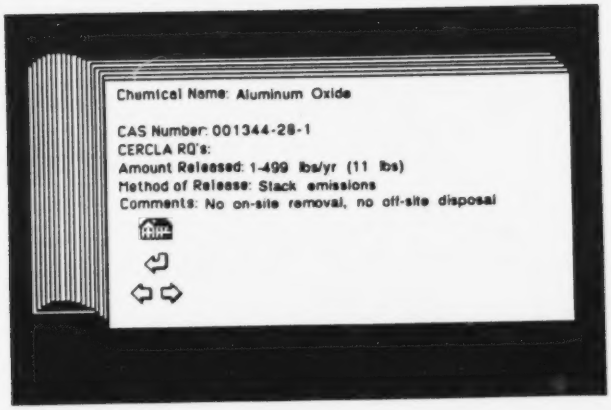

Chemical Name: Sodium Hydroxide
CAS Number: 001310-73-2
CERCLA RQ's: 5000 lbs (Acute) 1000 lbs (Aquatic Tox.)
Amount Released:
Method of Release:
Comments: 23,172 lbs discharged to POTW (Lebanon, IL)
No on-site removal

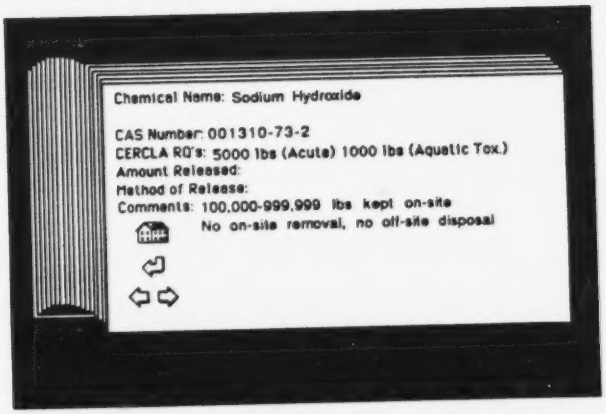

Company: Pfizer Pigments
Address: 2001 Lynch Avenue
(Location) East St. Louis, Illinois 62205
Contacts: Roger E. Rader, Plant Mgr., (618) 271-4700
Latitude/Longitude: 38/37/45; 90/07/30

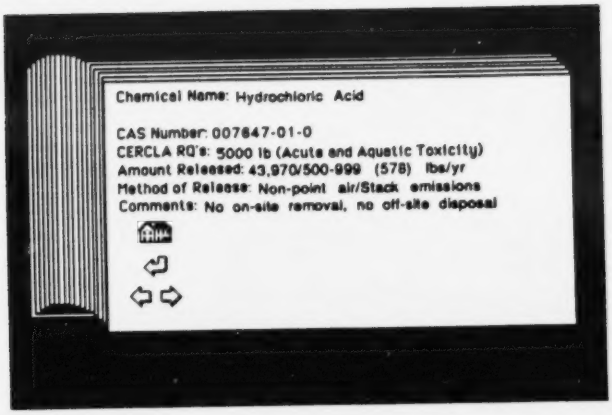

Chemical Name: Sodium Sulfate
CAS Number: 007757-82-6
CERCLA RQ's:
Amount Released:
Method of Release:
Comments: 10,000-99,999 lbs kept on-site
No off-site releases, no on-site removal

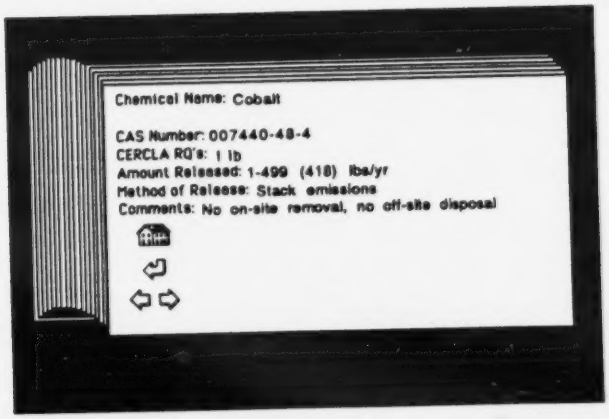

Chemical Name: Barium
CAS Number: 7440-39-3
CERCLA RQ's:
Amount Released: 1,824/1,161,802 lbs/yr
Method of Release: Stack emissions/Land disposal
Comments: No on-site removal, no off-site disposal

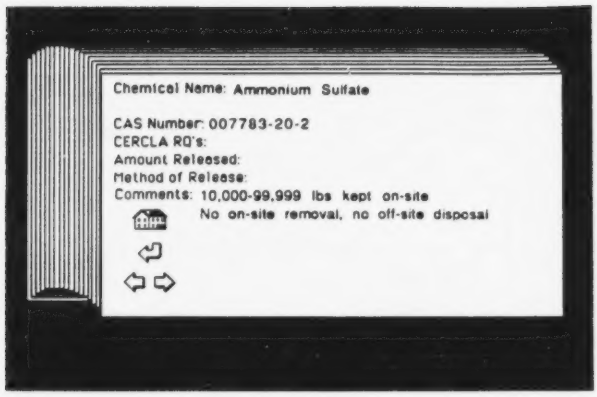

Chemical Name: Sulfuric Acid
CAS Number: 007664-93-9
CERCLA RQ's: 1000 lbs (Chronic and Aquatic Toxicity)
Amount Released: 1198 lbs/yr
Method of Release: Stack emissions
Comments: No on-site removal, no off-site disposal

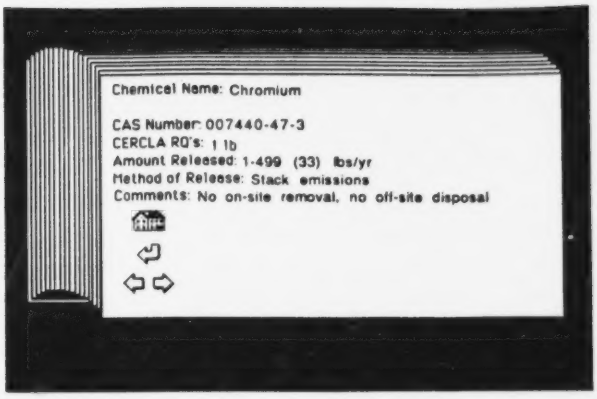

Chemical Name: Aluminum Oxide
CAS Number: 001344-28-1
CERCLA RQ's:
Amount Released: 1-499 lbs/yr (11 lbs)
Method of Release: Stack emissions
Comments: No on-site removal, no off-site disposal

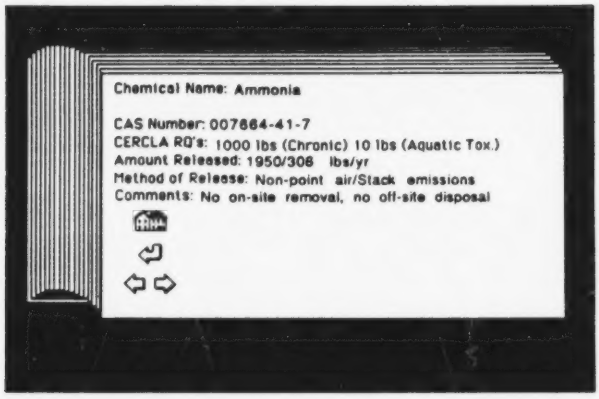

Chemical Name: Sodium Hydroxide
CAS Number: 001310-73-2
CERCLA RQ's: 5000 lbs (Acute) 1000 lbs (Aquatic Tox.)
Amount Released:
Method of Release:
Comments: 100,000-999,999 lbs kept on-site
No on-site removal, no off-site disposal

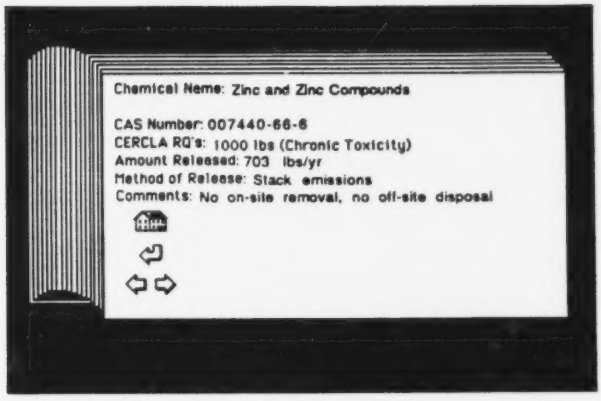

Chemical Name: Hydrochloric Acid
CAS Number: 007647-01-0
CERCLA RQ's: 5000 lb (Acute and Aquatic Toxicity)
Amount Released: 43,970/500-999 (578) lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: No on-site removal, no off-site disposal


Chemical Name: Cobalt
CAS Number: 007440-48-4
CERCLA RQ's: 1 lb
Amount Released: 1-499 (418) lbs/yr
Method of Release: Stack emissions
Comments: No on-site removal, no off-site disposal


Chemical Name: Ammonium Sulfate
CAS Number: 007783-20-2
CERCLA RQ's:
Amount Released:
Method of Release:
Comments: 10,000-99,999 lbs kept on-site
No on-site removal, no off-site disposal

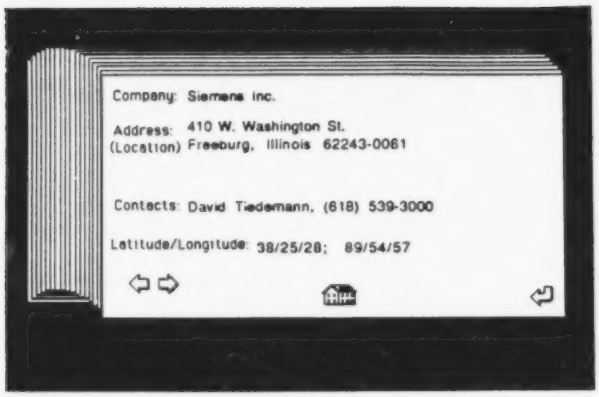

Chemical Name: Chromium
CAS Number: 007440-47-3
CERCLA RQ's: 1 lb
Amount Released: 1-499 (33) lbs/yr
Method of Release: Stack emissions
Comments: No on-site removal, no off-site disposal

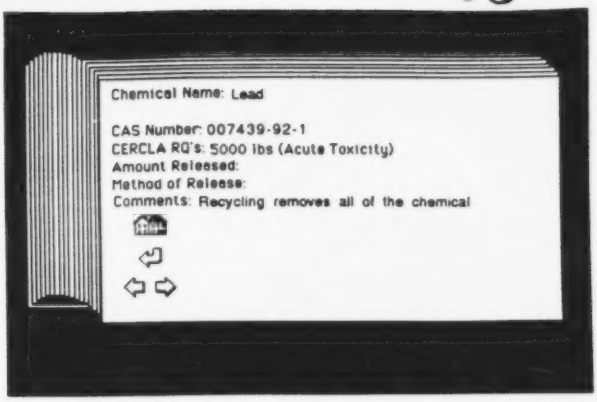

Chemical Name: Ammonia
CAS Number: 007664-41-7
CERCLA RQ's: 1000 lbs (Chronic) 10 lbs (Aquatic Tox.)
Amount Released: 1950/308 lbs/yr
Method of Release: Non-point air/Stack emissions
Comments: No on-site removal, no off-site disposal

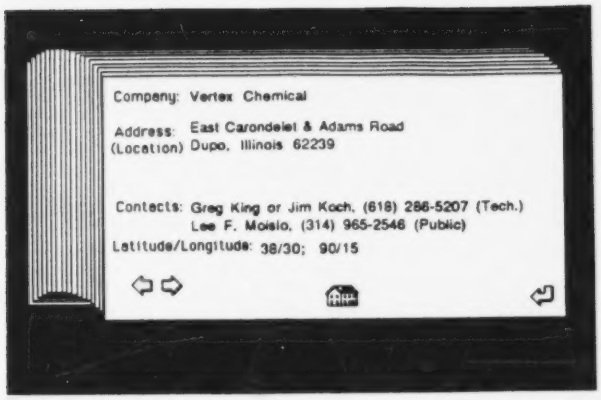

Chemical Name: Zinc and Zinc Compounds
CAS Number: 007440-66-6
CERCLA RQ's: 1000 lbs (Chronic Toxicity)
Amount Released: 703 lbs/yr
Method of Release: Stack emissions
Comments: No on-site removal, no off-site disposal

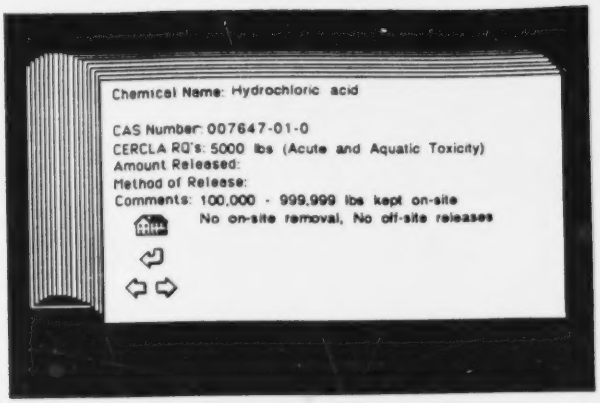
ois 62222
n. Koenigstein, (618) 233-2760
Longitude: N/A

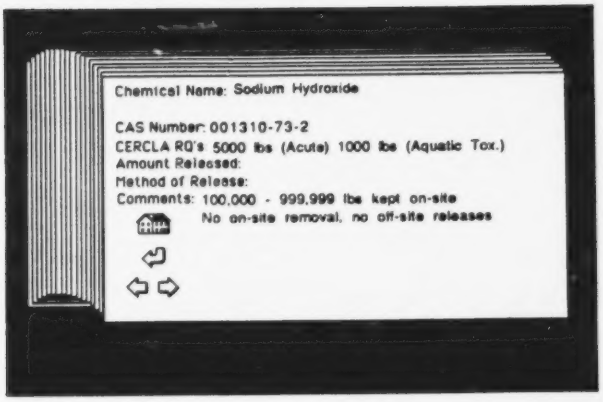
Chem
CAS Numb
CERCLA RQ's
Amount Relea
Method of Relea
Comments: 1-499
No on-s

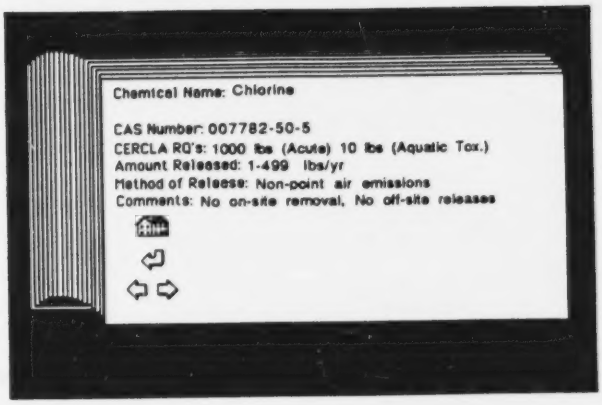

Company: Siemens Inc.
Address: 410 W. Washington St.
(Location) Freeburg, Illinois 62243-0061
Contacts: David Tiedemann, (618) 539-3000
Latitude/Longitude: 38/25/28; 89/54/57


Chemical Name: Lead
CAS Number: 007439-92-1
CERCLA RQ's: 5000 lbs (Acute Toxicity)
Amount Released:
Method of Release:
Comments: Recycling removes all of the chemical


Company: Vertex Chemical
Address: East Carondelet & Adams Road
(Location) Dupo, Illinois 62239
Contacts: Greg King or Jim Koch, (618) 286-5207 (Tech.)
Lee F. Moisio, (314) 965-2546 (Public)
Latitude/Longitude: 38/30; 90/15


Chemical Name: Hydrochloric acid
CAS Number: 007647-01-0
CERCLA RQ's: 5000 lbs (Acute and Aquatic Toxicity)
Amount Released:
Method of Release:
Comments: 100,000 - 999,999 lbs kept on-site
No on-site removal, No off-site releases


Chemical Name: Sodium Hydroxide
CAS Number: 001310-73-2
CERCLA RQ's 5000 lbs (Acute) 1000 lbs (Aquatic Tox.)
Amount Released:
Method of Release:
Comments: 100,000 - 999,999 lbs kept on-site
No on-site removal, no off-site releases


Chemical Name: Chlorine
CAS Number: 007782-50-5
CERCLA RQ's: 1000 lbs (Acute) 10 lbs (Aquatic Tox.)
Amount Released: 1-499 lbs/yr
Method of Release: Non-point air emissions
Comments: No on-site removal, No off-site releases

THE RISK SCREENING PROCEDURE

1. Preliminary Exposure Route and Target Organism Screen

   - Run a quick first pass through the "Plausible Routes of Exposure" section of the questionnaire to determine plausible routes of exposure to humans and ecological organisms. For example, if there are no drinking water intakes and no swimming or fishing in the vicinity (say, 10 Km) of a water discharge, then exposure potential to humans via surface water is low. (See note on distance in the questionnaire on page 4-13.)

   - Drop exposure routes determined to be implausible. These routes should be further evaluated during risk assessment, if determined necessary.

   - Fill out the "Site, Media, and Organisms of Concern" lines of the "Facility Risk Screening Worksheet." (NOTE: You need to fill out a separate worksheet for each media and each organism of concern.)

2. Assess Toxicological Potency

   - Look up and record the lowest RQ values of each chemical released into an environmental media for which there is a worksheet. See Exhibit 9 for guidance in assigning RQ values.

   - Complete the "Toxicological Potency" section in the Questionnaire.

   - Enter the chemicals assigned "high" and "medium" toxicological potencies in the appropriate sections on the facility worksheets under "Chemical Name." (Do not list chemicals assigned "low" toxicological potency.)

3. Determine Exposure Potential

   Release Quantities

   - Group facilities where emissions are close together (e.g., emission stacks or discharge pipes that are within perhaps 1 Km of each other)unless there are reasons not to do so (e.g., residences or recreational areas in between discharge locations). See note on distance in the questionnaire on page 4-12.

   - Add releases of chemicals in common among grouped facilities as though releases occurred from one site. Consider combining releases for any chemicals that are known to cause toxic effects by the same or similar mechanisms of action, or that have a common site of toxicity, (e.g., liver, lung). If the toxic effects of a chemical are not known, make a note to look up this information during the follow-up risk assessment, if determined necessary.

   - Complete the "Quantity of Release" portion of the questionnaire.

   - Fill in the "Release Quantity" columns in the "Facility Risk Screening Worksheet."

- Do not list "low" release quantities of "high" toxicological potency chemicals unless they are determined to be persistent.

- List "medium" release quantities of "medium" toxicological potency chemicals only if they are determined to be persistent.

- Do not list "medium" toxicological potency/"low" release chemicals.

- At this point, low and possibly some medium risk chemicals have been screened out.

Plausible Routes of Exposure

- Complete the "Plausible Routes of Exposure" section of the questionnaire for each chemical on each facility worksheet.

- For each chemical, assign and record under "Plausible Route" a "high" or "medium" ("lows" have been dropped in Step One) likelihood of exposure and level of confidence in each estimate

4. Rank Relative Risks

- Add any chemicals to the facility worksheet which were screened out using the above criteria, but for which you have reason to consider the need for further evaluation (e.g., metal compounds or other highly persistent chemicals, release points very close to exposure points, chemicals receiving public attention in your area).*

- If further ranking of chemicals on the facility worksheets is needed, the chemicals that scored "high" in all three columns ("Toxicological Potency," "Release Quantity," and "Plausible Route") should be ranked at the top of the risk list. Those that scored "high" in two of the three columns should be listed next, and those that scored "high" for only one of the three columns should be grouped at the bottom of the list.

- Compare worksheets for each organism of concern and media of interest in order to rank facilities according to their relative risks.

- Collect information necessary to increase the certainty in estimates of toxicological potency, release quantities, or plausible routes assigned a "low" or, in some cases, a "medium" level of confidence, before making a decision about the need for and focus of a chemical or site specific risk assessment. (See Exhibit 10 for useful sources of information.)

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*To conserve limited resources, keep the number of chemicals requiring follow-up risk assessment to a minimum. If a preliminary risk assessment is necessary on the chemicals you select from the facility worksheets, it should indicate the need to further expand the scope of the assessment to include additional chemicals dropped during risk screening. If, in the preliminary quantitative risk assessment, risks associated with your high chemical risk candidates are determined to be low, there is no need to further refine the risk assessment by addressing chemicals of lower risk potential.

THE QUESTIONNAIRE FOR QUALITATIVE RISK SCREENING

Instructions:

Circle the appropriate response. If you do not have enough information to answer the question, circle "insufficient data."

To the left of each question is a place to rank your confidence in your answer. To address your confidence in toxicolcgical potency, circle H if the exact identity of chemical and its RQ are known. Circle M or L if there is doubt about the chemical's identity (e.g., chemical is identified by generic name or chemical category), or if no RQ has been assigned to the chemical. For quantity of release, your confidence will be higher if you know that actual monitoring data were used to derive the estimate given on Form R and that the monitoring data were of high quality, or if specific estimates rather than ranges of releases are reported. For exposure, circle H when your answer is based on documented evidence and/or high quality data. Circle M or L if you have some uncertainty about the available information and your response.

TOXICOLOGICAL POTENCY

1. Is the appropriate RQ for the chemical:

Confidence				
H	M	L	5,000	A. Low
			100 to 1,000	B. Medium
			1 to 10	C. High

[NOTE: These ranges are provided only for example prior to the first data submissions. You should define your own ranges of "high," "medium," and "low."]

EXPOSURE POTENTIAL - AIR

QUANTITY OF RELEASE

1. Is the total quantity of release (both fugitive and stack emissions):

Confidence				
H	M	L	Less than 5,000 lbs/year	A. Low
			5,000 - 50,000 lbs/year	B. Medium
			Greater than 50,000 lbs/year	C. High

[NOTE: The quantity figures are provided only for example prior to the first data submissions. You should define your own categories here based on an analysis of the actual quantities emitted. For example, the three categories could be defined so that each category will contain approximately one third of the emissions reported.]

PLAUSIBLE ROUTES OF EXPOSURE

1. Confidence H M L — Is the site of release known?

A. Exactly (latitude and and longitude coordinates of discharge site known)

B. Nearly (facility street address known)

C. Approximately (facility zip code known)

D. Not at all

[NOTE: If the answer is "D - not at all," there are insufficient data to screen potential risks resulting from air emissions.]

2. Confidence H M L — Is there a population center or sensitive environment (see Glossary for definitions of these terms):

A. Relatively close to the release point

B. Somewhere in between A and C

C. Very far from the release point

D. Insufficient data

3. Confidence H M L — Is the population center or sensitive environment downwind of the release:

A. Often or always

B. Sometimes

C. Never

D. Insufficient data

[NOTE: The determination of "close" or "far" depends upon consideration of site-specific factors such as meteorology, topography, and chemical release height. In general, the higher the average wind speed in the direction of target organisms, the more direct the pathway from the point of release to target organisms (e.g., no intervening mountain ranges or the target organisms are not located in a valley over which the chemical plume may pass without falling), and the higher the stack from which the chemical is discharged, the further the chemical plume is likely to travel, and, in most instances, the "closer" the population center or sensitive environment should be considered to the release point. As a general guideline, "close" may vary from meters up to a kilometer and distances in excess of 10 kilometers will almost always be "far." In addition, the physical and chemical properties of a chemical may factor into a determination of what is "close" and "far." Chemicals that are solids, liquids, or adsorbent gases under ambient environmental conditions will tend to fall to the ground closer to the point of release than inert gases.]

4. Confidence H M L — Do environmental fate data indicate that the chemical is persistent in air (i.e., not likely to be degraded or otherwise removed from the air before the chemical plume reaches population centers or sensitive environments)?

A. Yes

B. No

C. Insufficient data

5. Confidence H M L — If ambient air monitoring data are available, was the point of monitoring:

A. Very close to the point of potential exposure
B. In between the release and exposure
C. Very close to the release point
D. Insufficient data

[See NOTE above.]

6. Confidence H M L — If A or B, can the presence of the chemical at the monitoring point be reasonably linked to the release?

A. Yes
B. No
C. Insufficient data

7. Confidence H M L — If standards or other threshold limits are available for the chemical in air, do the monitoring data indicate that levels of the chemical in ambient air were generally:

A. Above or around the limit
B. Below the limit
C. Insufficient data

CONSIDERING THE ABOVE FACTORS AND THEIR RELATIVE IMPORTANCE, would you say that the potential for exposure of the individual, population, or ecosystem to the emitted chemical is:

A. Low
B. Medium
C. High
D. Insufficient data

OVERALL CONFIDENCE

Considering the quantity and the quality of the available data, is your confidence in this data:

A. Low
B. Medium
C. High

EXPOSURE POTENTIAL - GROUND WATER/LAND

QUANTITY OF RELEASE

Is the quantity of release to land (including underground injection):

Confidence H M L		
	Less than 5,000 lbs/year	A. Low
	5,000 - 50,000 lbs/year	B. Medium
	Greater than 50,000 lbs/year	C. High

[NOTE: The quantity figures are provided only for example prior to the first data submissions. You should define your own categories here based on an

analysis of the actual quantities emitted. For example, the three categories could be defined so that each category contains exactly one third of the emissions reported.]

PLAUSIBLE ROUTES OF EXPOSURE

1. Confidence H M L — Is the disposal site known?

A. Exactly (latitude and and longitude coordinates of disposal site known) | B. Nearly (facility street address known) | C. Approximately (facility zip code known) | D. Not at all

[NOTE: If the answer is "D - not at all," there are insufficient data to screen potential risks resulting from ground water/land disposal.]

2. Confidence H M L — How likely is it that contamination will travel to a point of actual or potential use?

A. Fairly likely | B. Somewhere in between A and C | C. Very unlikely | D. Insufficient data

3. Confidence H M L — Are there streams or other surface water bodies near the area that the chemical is likely to enter - considering local weather conditions (e.g., high rainfall), topographical conditions (e.g., ground slope), and any environmental fate data available on the chemical (e.g., potential to evaporate)?

A. Yes | B. No | C. Insufficient data

[If the answer is "yes," also complete the section on surface water.]

4. Confidence H M L — Is there a potable ground-water (i.e., Class I or II) aquifer (see Glossary for definitions of terms) in the release area?

A. Yes | B. No | C. Insufficient data

[If the answer is "no" or "insufficient data," skip to surface water.]

5. Confidence H M L — If yes, considering the local geology (including soil porosity and depth to the aquifer) and environmental fate of the chemical in soil (e.g., hydrolysis, adsorption, water solubility), how likely is it that the chemical may reach the aquifer?

A. Fairly likely | B. Somewhere in between A and C | C. Very unlikely | D. Insufficient data

6. Confidence H M L — Are any high-priority ground waters endangered (i.e., Class I ground waters, well head protection areas, or other designated high priority areas)?

A. Yes B. No C. Insufficient data

7. Confidence H M L — Are public or private wells endangered in the immediate area or along the likely flow path?

A. Yes B. No C. Insufficient data

8. Confidence H M L — Do monitoring data show that the chemical is present in ground water or drinking water from the ground-water source:

a. Beneath the facility near the point of release?

A. Yes B. No C. Insufficient data

b. At the edge of the facility?

A. Yes B. No C. Insufficient data

c. At a currently used well?

A. Yes B. No C. Insufficient data

9. Confidence H M L — At any of the above locations, can the presence of the chemical at the monitoring point be reasonably linked to the release?

A. Yes B. No C. Insufficient data

10. Confidence H M L — If drinking water standards or similar threshold limits are available for the chemical in drinking water at any of the above locations, do the monitoring data indicate that levels of the chemical in the water were generally:

A. Above or around the limit B. Below the limit C. Insufficient data

CONSIDERING THE ABOVE FACTORS AND THEIR RELATIVE IMPORTANCE, would you say that the potential for exposure of the individual, population, or ecosystem to the emitted chemical is:

A. Low
B. Medium
C. High
D. Insufficient data

OVERALL CONFIDENCE

Considering the quantity and quality of the available data, is your confidence in this data:

A. Low
B. Medium
C. High

EXPOSURE POTENTIAL - SURFACE WATER

QUANTITY OF RELEASE

1. Is the quantity of release for discharges to surface water:

Confidence H M L		
	Less than 5,000 lbs/year	A. Low
	5,000 - 50,000 lbs/year	B. Medium
	Greater than 50,000 lbs/year	C. High

[NOTE: The quantity figures are provided only for example prior to the first data submissions. You should define your own categories here based on an analysis of the actual quantities emitted. For example, the three categories could be defined so that each category contains exactly one third of the emissions reported.]

PLAUSIBLE ROUTES OF EXPOSURE

1. Confidence H M L — Is the site of release known?

A. Exactly (latitude and and longitude coordinates of discharge site known)
B. Nearly (facility street address known)
C. Approximately (facility zip code known)
D. Not at all

[NOTE: If the answer is "D - not at all," there are insufficient data to screen potential risks resulting from surface water.]

2. Confidence H M L — Is a drinking water intake located downstream of the point of entry of the chemical into the surface water?

A. Yes B. No C. Insufficient data

3. Confidence H M L — Do people swim or boat in the water body into which the chemical is emitted?

A. Yes B. No C. Insufficient data

4. Confidence H M L — Are fish harvested from the water body for human consumption?

A. Yes B. No C. Insufficient data

5. Confidence H M L — If so, does the chemical bioaccumulate in these species?

A. Yes B. No C. Insufficient data

6. Confidence H M L — Are there any ecologically valuable fish in the water body into which the chemical is emitted?

A. Yes B. No C. Insufficient data

7. Confidence H M L — If the answer is "yes" to any of questions 1 through 5 above, is the location of potential exposure:

A. Very close to the the release? B. Somewhere in between A and C? C. Far from release? D. Insufficient data

[NOTE: The determination of "close or "far" depends upon consideration of site-specific factors such as surface water volume and flow rate, and distance from the chemical release point. In general, the smaller the stream or river, the faster the flow rate, and the more direct the pathway from the point of release to target organisms (e.g., on the same side of the river as a drinking water intake or recreational area, or near spawning areas in shallow, quiet areas of the water body), the "closer" the location of potential exposure should be considered to the release point. In addition, the physical and chemical properties of a chemical may factor into a determination of what is "close" and "far." Chemicals that are soluble and persistent in water will migrate further downstream than those that are volatile or insoluble and degrade in water.]

8. Confidence H M L — Do environmental data indicate that the chemical is persistent in water (i.e., not likely to be degraded or otherwise removed from the water)?

A. Yes B. No C. Insufficient data

9. Confidence H M L — If yes, do environmental fate data (e.g., log octanol/water partition coefficient) indicate that the chemical is more likely to be associated with suspended particulates and sediments?

A. Yes B. No C. Insufficient data

[NOTE: Adsorption to particles and sediments would tend to reduce potential exposures in drinking water, and increase exposures to "bottom-feeding" aquatic organisms. Exposures during water contact recreational activities would depend upon the turbidity in the area of these activities.]

10. Confidence H M L — Are monitoring data available that record the levels of the chemical in ambient water, drinking water, or in fish?

A. Yes B. No C. Insufficient data

11. Confidence H M L — If yes, can the presence of the chemical be reasonably linked to the release?

A. Yes B. No C. Insufficient data

12. Confidence H M L — If standards or similar threshold limits are available for the chemical in ambient water, drinking water, or fish, do the monitoring data indicate that the levels of the chemical were generally:

A. Above or around the limit B. Below the limit C. Insufficient data

CONSIDERING THE ABOVE FACTORS AND THEIR RELATIVE IMPORTANCE, would you say that the potential for exposure of individual, population, or ecosystem to the emitted chemical is:

A. Low
B. Medium
C. High
D. Insufficient data

OVERALL CONFIDENCE

Considering the quantity and the quality of the available data, is your confidence in this data:

A. Low
B. Medium
C. High

FACILITY RISK SCREENING WORKSHEET

Site: _____

Media (Air, Surface Water, Land/Ground Water): _____

Organisms of Concern (Human, Ecological/Aquatic or Ecological/Terrestrial):

_____

HIGH TOXICOLOGICAL POTENCY CHEMICALS

Chemical Name ( )[1]	Release Quantity ( )[2]	Plausible Route ( )[3]
A.		
B.		
C.		
D.		
E.		

MEDIUM TOXICOLOGICAL POTENCY CHEMICALS

Chemical Name ( )	Release Quantity ( )[4]	Plausible Route ( )
A.		
B.		
C.		
D.		
E.		

[1]Level of confidence (H, M, or L) in the toxicological potency is indicated within the parenthesis. (Under "Chemical Name", chemicals with RQ values are given an "H". The level of confidence in the toxicological potency for chemicals without RQ values should reflect the confidence in the estimation technique).

[2]Low release quantity chemicals are listed only if determined to be persistent.

[3]If "Plausible Route" is determined to be "Low" then potential risk is low for this media and organism. Therefore, a worksheet is <u>not</u> necessary.

[4]Medium release quantity chemicals are listed only if determined to be persistent. Low release quantity chemicals are <u>not</u> listed.

- ISCLT INPUT DATA -

```
NUMBER OF SOURCES =   4
NUMBER OF X AXIS GRID SYSTEM POINTS =   30
NUMBER OF Y AXIS GRID SYSTEM POINTS =   16
NUMBER OF SPECIAL POINTS =    0
NUMBER OF SEASONS =   1
NUMBER OF WIND SPEED CLASSES =   6
NUMBER OF STABILITY CLASSES =   6
NUMBER OF WIND DIRECTION CLASSES =  16
FILE NUMBER OF DATA FILE USED FOR REPORTS =   1
THE PROGRAM IS RUN IN URBAN MODE 3
CONCENTRATION (DEPOSITION) UNITS CONVERSION FACTOR =0.[illegible]00000000E+07
ACCELERATION OF GRAVITY (METERS/SEC**2) =  9.800
HEIGHT OF MEASUREMENT OF WIND SPEED (METERS) =  10.000
CORRECTION ANGLE FOR GRID SYSTEM VERSUS DIRECTION DATA NORTH (DEGREES) =   0.000
DECAY COEFFICIENT =0.00000000E+00
PROGRAM OPTION SWITCHES = 1, 2, 2, 0, 0, 3, 2, 3, 4, [illegible], 1, 0, 7,-8,-9, 0, 0, 0, 1, 0, 1, 0, 0, 1, 1,
ALL SOURCES ARE USED TO FORM SOURCE COMBINATION  1
  RANGE X AXIS GRID SYSTEM POINTS (METERS )=     166.67,     333.33,     500.00,     666.67,     833.33,    1000.00,
     1333.33,    1666.67,    2000.00,    2333.33,    2666.67,    3000.00,    3333.33,    3666.67,    4000.00,    4333.33,
     4666.67,    5000.00,    6666.67,    8333.33,   10000.00,   11666.67,   13333.33,   15000.00,   18333.33,   21666.67,
    25000.00,   33333.34,   41666.67,   50000.00,
AZIMUTH BEARING Y AXIS GRID SYSTEM POINTS (DEGREES)=       0.00,      22.50,      45.00,      67.50,      90.00,     112.50,
     135.00,     157.50,     180.00,     202.50,     225.00,     247.50,     270.00,     292.50,     315.00,     337.50,
```

- AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	291.9000	291.9000	291.9000	286.500[illegible]	281.1000	[illegible]1.1000

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.203250E+04	0.203250E+04	0.203250E+04	0.203250E+04	0.203250E+04	0.203250E+04
STABILITY CATEGORY 2	0.135500E+04	0.135500E+04	0.135500E+04	0.135500E+04	0.135500E+04	0.135500E+04
STABILITY CATEGORY 3	0.135500E+04	0.135500E+04	0.135500E+04	0.135500E+04	0.135500E+04	0.135500E+04
STABILITY CATEGORY 4	0.881500E+03	0.881500E+03	0.881500E+03	0.881500E+03	0.881500E+03	0.881500E+03
STABILITY CATEGORY 5	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05
STABILITY CATEGORY 6	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00018999	0.00020999	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00041997	0.00026998	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00031998	0.00026998	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00030998	0.00047997	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00011999	0.00026998	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00028998	0.00020999	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00034998	0.00033998	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00012999	0.00007000	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00021999	0.00026998	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00006000	0.00013999	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00018999	0.00020999	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00015999	0.00013999	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00011999	0.00026998	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00015999	0.00013999	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00022999	0.00007000	0.00000000	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00054997	0.00115993	0.00088995	0.00000000	0.00000000	0.00000000
22.500	0.00037998	0.00095994	0.00054997	0.00000000	0.00000000	0.00000000
45.000	0.00054997	0.00115993	0.00061996	0.00000000	0.00000000	0.00000000
67.500	0.00032998	0.00122993	0.00047997	0.00000000	0.00000000	0.00000000
90.000	0.00100994	0.00211987	0.00095994	0.00000000	0.00000000	0.00000000
112.500	0.00060996	0.00095994	0.00088995	0.00000000	0.00000000	0.00000000
135.000	0.00044997	0.00088995	0.00081995	0.00000000	0.00000000	0.00000000
157.500	0.00054997	0.00109993	0.00081995	0.00000000	0.00000000	0.00000000
180.000	0.00086995	0.00218987	0.00225986	0.00000000	0.00000000	0.00000000
202.500	0.00072996	0.00150991	0.00150991	0.00000000	0.00000000	0.00000000
225.000	0.00052997	0.00177989	0.00102994	0.00000000	0.00000000	0.00000000
247.500	0.00085995	0.00211987	0.00150991	0.00000000	0.00000000	0.00000000
270.000	0.00109993	0.00225986	0.00157990	0.00000000	0.00000000	0.00000000
292.500	0.00043997	0.00157990	0.00115993	0.00000000	0.00000000	0.00000000
315.000	0.00057997	0.00143991	0.00074995	0.00000000	0.00000000	0.00000000
337.500	0.00018999	0.00129992	0.00047997	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -
SEASON 1
STABILITY CATEGORY 3

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00065996	0.00109993	0.00335980	0.00140998	0.00000000	0.00000000
22.500	0.00032998	0.00102994	0.00170990	0.00043999	0.00000000	0.00000000
45.000	0.00057997	0.00109993	0.00136992	0.00020999	0.00000000	0.00000000
67.500	0.00049997	0.00109993	0.00170990	0.00043999	0.00000000	0.00000000
90.000	0.00071996	0.00143991	0.00328980	0.00074998	0.00000000	0.00000000
112.500	0.00051997	0.00115993	0.00383977	0.00020999	0.00000000	0.00000000
135.000	0.00021999	0.00081995	0.00513969	0.00074997	0.00000000	0.00000000
157.500	0.00033998	0.00109993	0.00439970	0.00067996	0.00000000	0.00000000
180.000	0.00041997	0.00204988	0.00848949	0.00170990	0.00007000	0.00007000
202.500	0.00016999	0.00102994	0.00437974	0.00074995	0.00000000	0.00000000
225.000	0.00043997	0.00115993	0.00437974	0.00050995	0.00000000	0.00000000
247.500	0.00070996	0.00184989	0.00492970	0.00067996	0.00000000	0.00000000
270.000	0.00103994	0.00191983	0.00615963	0.00044996	0.00013999	0.00000000
292.500	0.00048997	0.00150991	0.00520969	0.00021995	0.00000000	0.00007000
315.000	0.00054997	0.00184989	0.00321981	0.00050998	0.00000000	0.00000000
337.500	0.00009999	0.00061996	0.00136992	0.00020999	0.00000000	0.00000000

SEASON 1
STABILITY CATEGORY 4

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00112993	0.00437974	0.01451913	0.01140928	0.00040998	0.00000000
22.500	0.00071996	0.00485971	0.00821951	0.00335980	0.00020999	0.00007000
45.000	0.00044997	0.00389977	0.00615963	0.00335980	0.00020999	0.00000000
67.500	0.00112993	0.00444973	0.00746955	0.00294982	0.00013999	0.00000000
90.000	0.00158990	0.00979941	0.01581905	0.00629963	0.00047997	0.00007000
112.500	0.00110993	0.00657960	0.01609903	0.01013959	0.00061996	0.00007000
135.000	0.00076995	0.00567966	0.02376857	0.01869888	0.00109993	0.00007000
157.500	0.00082995	0.00424974	0.02061876	0.02424854	0.00157996	0.00033998
180.000	0.00064996	0.00485971	0.02615843	0.02679839	0.00232993	0.00020999
202.500	0.00021999	0.00246985	0.00876947	0.00471971	0.00020999	0.00000000
225.000	0.00031998	0.00287983	0.00739955	0.00591958	0.00047997	0.00020999
247.500	0.00061996	0.00561966	0.01026938	0.01141931	0.00177994	0.00047997
270.000	0.00098994	0.00814951	0.01602904	0.02441853	0.00759974	0.00232993
292.500	0.00112993	0.00567966	0.01691898	0.03179810	0.00725976	0.00211987
315.000	0.00068996	0.00547967	0.01294922	0.01859882	0.00157996	0.00040998
337.500	0.00043997	0.00333977	0.01129932	0.00979841	0.00033998	0.00000000

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00018999	0.00020999	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00041997	0.00026998	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00031998	0.00026998	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00030998	0.00047997	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00011999	0.00026998	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00028998	0.00020999	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00034998	0.00033998	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00012999	0.00007000	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00021999	0.00026998	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00006000	0.00013999	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00018999	0.00020999	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00015999	0.00013999	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00011999	0.00026998	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00015999	0.00013999	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00022999	0.00007000	0.00000000	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00054997	0.00115993	0.00088995	0.00000000	0.00000000	0.00000000
22.500	0.00037998	0.00095994	0.00054997	0.00000000	0.00000000	0.00000000
45.000	0.00054997	0.00115993	0.00061996	0.00000000	0.00000000	0.00000000
67.500	0.00032998	0.00122993	0.00047997	0.00000000	0.00000000	0.00000000
90.000	0.00100994	0.00211987	0.00095994	0.00000000	0.00000000	0.00000000
112.500	0.00060996	0.00095994	0.00088995	0.00000000	0.00000000	0.00000000
135.000	0.00044997	0.00088995	0.00081995	0.00000000	0.00000000	0.00000000
157.500	0.00054997	0.00109993	0.00081995	0.00000000	0.00000000	0.00000000
180.000	0.00086995	0.00218987	0.00225986	0.00000000	0.00000000	0.00000000
202.500	0.00072996	0.00150991	0.00150991	0.00000000	0.00000000	0.00000000
225.000	0.00052997	0.00177989	0.00102994	0.00000000	0.00000000	0.00000000
247.500	0.00085995	0.00211987	0.00150991	0.00000000	0.00000000	0.00000000
270.000	0.00109993	0.00225986	0.00157990	0.00000000	0.00000000	0.00000000
292.500	0.00043997	0.00157990	0.00115993	0.00000000	0.00000000	0.00000000
315.000	0.00057997	0.00143991	0.00074995	0.00000000	0.00000000	0.00000000
337.500	0.00018999	0.00129992	0.00047997	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 3

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8[illegible]MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00065996	0.00109993	0.00335980	0.00[illegible]	0.00000000	0.00000000
22.500	0.00032995	0.00102994	0.00170990	0.00[illegible]	0.00000000	0.00000000
45.000	0.00057997	0.00109993	0.00136992	0.00[illegible]	0.00000000	0.00000000
67.500	0.00049997	0.00109993	0.00170990	0.00[illegible]	0.00000000	0.00000000
90.000	0.00071996	0.00143991	0.00328980	0.00[illegible]	0.00000000	0.00000000
112.500	0.00051997	0.00115993	0.00383977	0.00[illegible]	0.00000000	0.00000000
135.000	0.00021999	0.00081995	0.00513969	0.00[illegible]	0.00000000	0.00000000
157.500	0.00033998	0.00109993	0.00499970	0.00[illegible]	0.00000000	0.00000000
180.000	0.00041997	0.00204988	0.00848949	0.00[illegible]	0.00007000	0.00007000
202.500	0.00016999	0.00102994	0.00437974	0.00[illegible]	0.00000000	0.00000000
225.000	0.00043997	0.00115993	0.00437974	0.00[illegible]	0.00000000	0.00000000
247.500	0.00070996	0.00184989	0.00492970	0.00[illegible]	0.00000000	0.00000000
270.000	0.00103994	0.00191988	0.00615963	0.00[illegible]	0.00013999	0.00000000
292.500	0.00048997	0.00150991	0.00520969	0.00[illegible]	0.00000000	0.00007000
315.000	0.00054997	0.00184989	0.00321981	0.00[illegible]	0.00000000	0.00000000
337.500	0.00009999	0.00061996	0.00136992	0.00[illegible]	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 4

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8[illegible]MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00112993	0.00437974	0.01451913	0.01[illegible]	0.00040998	0.00000000
22.500	0.00071996	0.00485971	0.00821951	0.00[illegible]	0.00020999	0.00007000
45.000	0.00044997	0.00389977	0.00615963	0.00[illegible]	0.00020999	0.00000000
67.500	0.00112993	0.00444973	0.00746955	0.00[illegible]	0.00013999	0.00000000
90.000	0.00158990	0.00978941	0.01581905	0.00[illegible]	0.00047997	0.00007000
112.500	0.00110993	0.00657960	0.01609903	0.01[illegible]	0.00061996	0.00007000
135.000	0.00076995	0.00567966	0.02376857	0.01[illegible]	0.00109993	0.00007000
157.500	0.00082995	0.00424974	0.02061876	0.02[illegible]	0.00157990	0.00033998
180.000	0.00064996	0.00485971	0.02615843	0.02[illegible]	0.00232986	0.00020999
202.500	0.00021999	0.00246985	0.00876947	0.00[illegible]	0.00020999	0.00000000
225.000	0.00031998	0.00287983	0.00739955	0.00[illegible]	0.00047997	0.00020999
247.500	0.00061996	0.00561966	0.01026938	0.01[illegible]	0.00177989	0.00047997
270.000	0.00098994	0.00814951	0.01602904	0.02[illegible]	0.00754964	0.00232986
292.500	0.00112993	0.00567966	0.01691898	0.03[illegible]	0.00725970	0.00211987
315.000	0.00068996	0.00547967	0.01294922	0.01[illegible]	0.00157990	0.00040998
337.500	0.00043997	0.00383977	0.01129932	0.00[illegible]	0.00033998	0.00000000

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 5

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00000000	0.00232986	0.00259984	0.00000000	0.00000000	0.00000000
22.500	0.00000000	0.00300982	0.00088995	0.00000000	0.00000000	0.00000000
45.000	0.00000000	0.00122993	0.00122993	0.00000000	0.00000000	0.00000000
67.500	0.00000000	0.00150991	0.00143991	0.00000000	0.00000000	0.00000000
90.000	0.00000000	0.00581965	0.00307981	0.00000000	0.00000000	0.00000000
112.500	0.00000000	0.00732956	0.00444973	0.00000000	0.00000000	0.00000000
135.000	0.00000000	0.00410975	0.00691958	0.00000000	0.00000000	0.00000000
157.500	0.00000000	0.00204988	0.01191928	0.00000000	0.00000000	0.00000000
180.000	0.00000000	0.00451973	0.01615903	0.00000000	0.00000000	0.00000000
202.500	0.00000000	0.00191988	0.00437974	0.00000000	0.00000000	0.00000000
225.000	0.00000000	0.00177989	0.00615963	0.00000000	0.00000000	0.00000000
247.500	0.00000000	0.00273984	0.00691958	0.00000000	0.00000000	0.00000000
270.000	0.00000000	0.00396976	0.00835950	0.00000000	0.00000000	0.00000000
292.500	0.00000000	0.00225986	0.00677959	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00136992	0.00499970	0.00000000	0.00000000	0.00000000
337.500	0.00000000	0.00150991	0.00239986	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 6

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00255985	0.00287983	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00318981	0.00355979	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00260984	0.00307981	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00348979	0.00246985	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00548967	0.00835950	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00756954	0.01013939	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00333980	0.00691958	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00203988	0.00417975	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00333980	0.00849949	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00171990	0.00239986	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00267984	0.00520969	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00405976	0.00794952	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00829950	0.01088934	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00363978	0.00547967	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00135992	0.00170990	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00076995	0.00150991	0.00000000	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- VERTICAL POTENTIAL TEMPERATURE GRADIENT (DEGREES KELVIN/METER) -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+00
STABILITY CATEGORY 2	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+00
STABILITY CATEGORY 3	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+00
STABILITY CATEGORY 4	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+00
STABILITY CATEGORY 5	0.200000E-010	0.200000E-010	0.200000E-010	0.200000E-010	0.200000E-010	0.200000E-01
STABILITY CATEGORY 6	0.350000E-010	0.350000E-010	0.350000E-010	0.350000E-010	0.350000E-010	0.350000E-01

- WIND PROFILE POWER LAW EXPONENTS -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.150000E+000	0.150000E+000	0.150000E+000	0.150000E+000	0.150000E+000	0.150000E+00
STABILITY CATEGORY 2	0.150000E+000	0.150000E+000	0.150000E+000	0.150000E+000	0.150000E+000	0.150000E+00
STABILITY CATEGORY 3	0.200000E+000	0.200000E+000	0.200000E+000	0.200000E+000	0.200000E+000	0.200000E+00
STABILITY CATEGORY 4	0.250000E+000	0.250000E+000	0.250000E+000	0.250000E+000	0.250000E+000	0.250000E+00
STABILITY CATEGORY 5	0.300000E+000	0.300000E+000	0.300000E+000	0.300000E+000	0.300000E+000	0.300000E+00
STABILITY CATEGORY 6	0.300000E+000	0.300000E+000	0.300000E+000	0.300000E+000	0.300000E+000	0.300000E+00

- SOURCE INPUT DA[illegible] -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1011	AREA	-15.00	-15.00	6.10	0.00	WIDTH [illegible] AREA (M)= 20.00

- SOURCE STRENGTHS (GRAMS PER SEC PER SQUARE METER) -

SEASON 1	SEASON 2	SEASON 3	SEASON 4
1.89000E-04			

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		2012	AREA	-15.00	-15.00	6.10	0.00	WIDTH OF AREA (M)= 30.00

- SOURCE STRENGTHS (GRAMS PER SEC PER SQUARE METER) -

SEASON 1	SEASON 2	SEASON 3	SEASON 4
0.00000E+00			

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / / ELEV- / / ATION / / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		4014	STACK	0.00	0.00	6.10	0.00	GAS EXIT TEMP (DEG K)= 293.00, GAS EXIT VEL. (M/SEC)= 3.00, STACK DIAMETER (M)= 0.080, HEIGHT OF ASSO. BLDG. (M)= 6.10, WIDTH OF ASSO. BLDG. (M)= 30.00, WAKE EFFECTS FLAG = 0 - SOURCE STRENGTHS (GRAMS PER SEC) - SEASON 1 SEASON 2 SEASON 3 SEASON 4 4.50000E-01

WARNING - HW/HB > 5 FOR SOURCE 4014 PROG. USES LATERAL VIRTUAL DIST. FOR UPPER BOUND OF CONCENTRATION (DEPOSITION). IF LOWER BOUND IS DESIRED SET WAKE EFFECTS FLAG (WAKE) = 1 AND RERUN

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE ELEV- ATION (M)	- SOURCE DETAILS DEPENDING ON TYPE -
X		3013	STACK	0.00	0.00	6.10	0.00	GAS EXIT TEMP (DEG K)= 293.00, GAS EXIT VEL. (M/SEC)= 1.00, STACK DIAMETER (M)= 0.080, HEIGHT OF ASSO. BLDG. (M)= 6.10, WIDTH OF ASSO. BLDG. (M)= 30.00, WAKE EFFECTS FLAG = 0 - SOURCE STRENGTHS (GRAMS PER SEC) - SEASON 1 SEASON 2 SEASON 3 SEASON 4 1.50000E-01

WARNING - HW/HB > 5 FOR SOURCE 3013 PROG. USES LATERAL VIRTUAL DIST. FOR UPPER BOUND OF CONCENTRATION (DEPOSITION). IF LOWER BOUND IS DESIRED SET WAKE EFFECTS FLAG (WAKE) = 1 AND RERUN